

THE DOCK & HARBOUR AUTHORITY

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Editorial Comments.

CARDIFF DOCK FACILITIES.

From time to time attention has been directed to various works in connection with the ports of the Great Western Railway Company, and to the extensive character of the undertakings which constitute the largest group of docks under unified control in the world. The threads of the story have now been woven together and appear in a compact but comprehensive publication entitled "New Works and Facilities at the South Wales Ports." This survey traces the progress which has been made since 1921, when the amalgamations provided by the Railways Act of that year resulted in the acquisition of the Bute Docks, Cardiff, Newport Docks, Barry Docks, Port Talbot Docks and Penarth Docks. A further extension of the field of activity came about by the Swansea Harbour Vesting Act, 1923, when the Swansea Harbour Trust and its docks was added to the group.

The administrative autonomy thereby constituted facilitated in a high degree development at the South Wales Ports correlated with improvements on the purely railway side of the organisation, as conspicuously illustrated by the advent of 20-ton wagons for transporting coal. From 1922 onwards work in this direction has been advanced, involving a wholesale discarding of shipping appliances at the docks. An initial sum of £200,000 was earmarked for new and reconstructed tips as circumstances required, and £175,000 for the rearrangement and extension of lines serving them. The railway itself built 1,000 20-ton wagons, which were hired out to collieries. A rebate of five per cent. in rail rates was made in respect of coal conveyed in fully-laden 20-ton wagons, and a reduction of 20 per cent. in the charges for shipping and weighing coal from such wagons. To date £500,000 has been expended on the improved wagon scheme.

Since the amalgamation, storage capacity for coal has also been increased. At Bute Docks, Cardiff, a group of sidings for 1,417 wagons was laid at the back of the Coal Washery at the Queen Alexandra Dock, providing also a reserve of coal for the shipping appliances. At Roath Dock, Cardiff, a second group of sidings for 1,229 wagons was added. This is linked with six reception sidings for 70-wagon load trains from the collieries, and there is a hump for siding and shunting. Track for outgoing general traffic has been further augmented by sidings for 250 wagons located alongside Swansea Street. Feed roads to the coal hoists on the east side of Roath Basin and storage sidings at the north-east end have been reconstructed and extended, in the latter case, further to accommodate empty wagons from Roath and Queen Alexandra Docks.

At Cardiff only three coal tips were suited for adaptation to 20-ton wagons. To-day there are seven tips for this purpose at East Dock and four at Queen's Dock. Track has been extended at Queen Alexandra Dock, and on the west side of East Dock the high level lines have been remodelled.

The installation of new appliances called for more power. Production plant at the amalgamation was of mixed character, part was modern, much required renewal and certain machinery was very old. The original Bute West Dock was opened as long ago as 1839, and the last extension, the Queen Alexandra Dock, in 1907. The supply stations were scattered, the hydraulic power for hoists, cranes, lock gates and bridges being produced at ten separate centres, involving transmission through many miles of mains.

The number of power stations has now been reduced from ten to four, and the bulk of the plant concentrated in one central station supplying hydraulic pressure in various directions through a new system of steel mains with auxiliary stations at the end of each. The principal power plant comprises four sets of 650 h.p. turbo-electric pumps, working on electric current of 6,600 volts, 50 cycles, supplied by Cardiff Corporation. Each pump will deliver 800 gallons of water per minute at 800 lbs. pressure. Fresh water is used instead of salt, thereby surmounting endless difficulties in the way of corrosion of plant and mains. Exhaust water is returned to large concrete tanks at the power stations. The technique of the change-over com-

mands admiration, when it is remembered that the same buildings have been largely utilised whilst maintaining the daily supply of power to all parts of the docks.

Whilst this improvement of the internal arrangements at Cardiff Docks had gone forward, the wider vista of the port's relationship to the trade of South Wales and the Midlands was not neglected. Recognition of the vital corollary, more especially in the service of general cargo for the communities of these populous areas, was marked by purchasing the three large sheds built by the Government at Queen Alexandra Dock during the war. Arrangements were made for the further installation of electric conveyor belts for the handling of bulk grain and commodities in bags and cases. Overhead electric conveyors already existed between certain of these warehouses and an additional unit has recently been erected between G and C sheds, which is able to handle cases weighing up to 200 lbs. A connecting gangway has been built between the cold stores and the adjoining G warehouse, whilst electric trollies with demountable bodies have been put into service for the rapid handling of goods.

On the west side of the East Dock, Cardiff, a discharging berth for coal had to be dismantled. To provide a substitute, three old coal tips on the east side of the dock were discarded, and six modern hydraulic cranes erected in their place. The lay-out of the railway track was improved and an hydraulic crane installed near the Stuart Warehouse on the same side of the dock. A new weighbridge was provided at the King's Wharf, north-east end of Queen Alexandra Dock, and the extensive rearrangement of lines has facilitated the working of pit wood and other cargoes there. Three further new general cargo cranes are also in course of construction for Roath Dock.

Grain handling equipment has been increased by the provision of a new floating suction elevator at the Bute Docks, Cardiff, which will discharge 120 tons of bulk grain per hour from ship to truck, from ship to shed, or overside to barge, and is equipped with automatic weighing.

Whilst increased provision for cargo on land and water has been made, the requirements of vessels themselves have not been neglected, and at East Dock, Cardiff, ships of 48 ft. 5 in. beam, on a draught of 22 ft. 6 in. can now enter from the East Dock Basin, against a previous beam limit of 43 ft. 6 in. This has been effected by cutting away the masonry curve of the invert of the Inner Lock Entrance. The sill level at the Commercial Graving Dock has also been widened, thereby extending the beam limit for vessels by 2 ft. to 58 ft.

Road access to Cardiff Docks is also being improved. The swing bridge over the West Dock Lock, near the main entrance to the docks has been adapted to hydraulic power in place of the old method of working it by hand, thereby reducing the delay when closed to road traffic during the passage of ships. An improvement to the same end has been authorised by the condemning of the single track two-leaf movable road bridge over the Inner Lock of the Bute East Dock, and its proposed replacement by a double track swing bridge to be located over the East Dock Outer Lock, with suitable approach roads. It is anticipated that this will provide a more convenient way for traffic between the Roath and Queen Alexandra Docks and the main entrance to the docks. This scheme is now in hand.

Electric light has been installed in a number of warehouses and transit sheds, as well as at various points of the docks, power connections being also fitted at the sheds for operating the electric conveyors. The cattle lairs at Roath Docks were overhauled and renovated upon the lifting of the embargo on the import of Canadian cattle, and some thousands of head have been imported through Cardiff.

Other works effected at Cardiff include the provision of special supplementary "storm-strut" gates at Queen Dock to prevent the main gates being damaged in stormy weather. Telephones have been reorganised and an allied traffic control system instituted. Improvements on the same broad lines have taken place at Swansea, Newport, Barry, Port Talbot, Penarth and Plymouth.

Notes of the Month.

DEATH OF MERSEY DOCKS OFFICIAL.

The death took place recently of Mr. W. Davies, for the past twenty years superintendent of graving docks, Mersey Docks and Harbour Board.

AVONMOUTH DOCK OPENING.

The Prince of Wales is to open the eastern arm of the Royal Edward Dock extension at Avonmouth, Bristol, on May 23rd. A reception will be held on the first floor of Transit Shed U, on the east side of the new arm.

CHERBOURG DREDGING CONTRACT.

On March 29th a contract amounting to 350,000 francs was offered by the "Direction de l'Intendance Maritime, Cherbourg," for dredging work to be carried out at the Cherbourg Naval Base.

PANAMA SHIPPING REGULATIONS.

Consuls of Panama are authorised to visa shipping documents made out to the order of the shipper if the exporter is a responsible party and has a responsible agent at the port of entry, and the exporter is to be held accountable according to an amendment to the revised Consular regulations of Panama.

FACILITIES AT PORT OKHA.

The Department of Commerce and Industry, Baroda State, India, has issued an interesting brochure dealing with the facilities available at Port Okha, Kathiawar. The valuable information contained in this publication is clearly scheduled, and is supported by some excellent photographs.

NEW WESTMINSTER TERMINAL.

Approval has been given by the Dominion Government to the award by the New Westminster Harbour Commissioners of the contract for the erection of the new one-million-bushel elevator in that port. Construction will be begun immediately and the elevator, which will cost \$460,000, is to be completed by September. It will have facilities for handling about forty cars of grain per 10-hour day and for loading ships at the rate of 25,000 bushels per hour.

MERSEY DOCKS BILL.

A Bill promoted by the Mersey Docks and Harbour Board for various powers has been passed for third reading by the Unopposed Bills Committee of the House of Commons. The Board asks for extension of time, until 1940, for the completion of certain dock works that have been in progress for many years on the Liverpool side of the Mersey. The Bill also asks for additional borrowing powers for these works of £2,500,000.

PLANT FOR WEST INDIES.

Messrs. Blackstone & Co., Ltd., Stamford, England, have received an order from the Crown Agents for the Colonies in respect of the Port of Grenada, British West Indies, for two oil engine-driven electric generator sets of 40 kilowatts each.

Each set will be driven by 73 b.h.p. cylinder cold-starting spring injection oil engines of a type specially designed for driving alternators in parallel. The total value of the order is £3,450.

DUTCH SHIPPING CONTRACTS.

The De Maas Shipbuilding Company, Slikkerveer, Holland, have secured a further contract for the construction of six motor ships to be fitted with Sulzer Diesel engines. The dimensions are 165 ft. by 28 ft. 8 in. by 10 ft. On March 12th the s.s. "Thedens" underwent satisfactory trials and was taken over by the owners. Her dimensions are 299 ft. 11 in. by 45 ft. 11 in. by 17 ft. The triple engines are by Fynevord, Rotterdam, and the speed 12½ knots. There is accommodation for 30 first class passengers.

ORE HANDLING AT NEW ORLEANS.

The import movement of aluminium ore, or bauxite, through the Port of New Orleans is showing a tremendous growth during the present year, and is expected to reach unprecedented totals. Between September 1st, 1927, the beginning of the fiscal year, and January 14th, 1928, 105,499 tons of this ore has been received and transhipped through the bulk commodity handling plant of the Board of Commissioners of the Port of New Orleans. This compares with receipts of 62,697 tons during the same period of the previous year.

This commodity is received in full cargoes by ships of the Aluminium Line from the Guianas. Probably 90 per cent. of the total is immediately transhipped through the bulk commodity handling plant into barges of the Mississippi-Warrior service which carry it to the refining plant at St. Louis. The vessels of the Aluminium Line invariably carry large cargoes of general merchandise on their south-bound voyage.

WALSH ISLAND DOCKYARD.

It is stated that the New South Wales Government has decided to close down the Walsh Island Dockyard owing to labour difficulties arising out of payment by results.

LONG DISTANCE TOW.

On February 24th a tow of six barges, carrying 7,000 tons of sisal, left New Orleans for St. Paul, Minn., propelled by the Inland Waterways steamer "Ashburn." This is the first tow of the season to any point as far north as St. Paul, and is one of the largest shipments ever made for that distance by the Federal barge line.

ENGINEERS' TRAVELS.

Engineers' travels in America were the subject of a discussion at a meeting of the Institution held on March 2nd, on the occasion of a talk by Mr. Arthur Abbey on his recent visit to the United States. Mr. W. J. Tennant, who has also recently returned from foreign travels, was in the chair.

Mr. Abbey described his visits to the big towns and to large engineering works, factories for gears, cars, petrol pumps, coal-cutting machines and grinding wheels being some of those that he mentioned. Together with his observations on the technical side of his visit, Mr. Abbey commented generally upon travelling in America: about trains, hotels, streets, not omitting travelling companions, and he showed many illustrations on the screen.

Mr. Tennant's contribution to the discussion following Mr. Abbey's talk, was full of anecdotes of incidents of travel; and Mr. Robert Lowe, who has spent twelve years in Canada and the United States, spoke of the readiness of Americans to show visitors over their works. Mr. J. M. Muir, from Mexico, and many other members and visitors took part in the discussion.

Water Softening Plant on Cunard Steamships.

An Interesting Development in Marine Work.

The importance of the treatment of boiler feed water in ordinary land practice, such as docks and harbours, for example, does not require much emphasis, and a striking indication of much greater attention now being given afloat to scientific methods in this connection is the use on steamships of plant for softening the make-up water. The average liner or other large vessel has to take on ordinary fresh water which may be anything from 5 deg. to 40 deg. total hardness, depending on the port of call, to use as make-up for the boilers, which leads to a certain amount of scale formation. Very interesting, therefore, is the fact that the Paterson Engineering Co., Ltd., of London, have just recently supplied to the Cunard Steamship Company three sets of their "Basex" water softeners, giving zero hardness to the make-up water for the steam boilers. In this way there is not added to the distilled water any trace of scale-forming material, which is equally important for the efficient operation of the "Scotch" and the water tube boiler.

The three steamships are the "ss. Carmania," the "ss. Caronia," and the "ss. Mauretania," and in the latter case the complete plant is two "Basex" units, each 2 ft. 6 in. diameter, with the usual brine preparing tank and steam jet elevator, and one 3 ft. 6 in. diameter pressure filter, provided with steam jet air injector, and steam valve for the agitation of the filtering medium. The capacity of the plant is 1,400 gallons of zero hardness water per hour, with a total duty of 11,200 gallons between regeneration by means of salt solution, which only requires about twenty minutes.

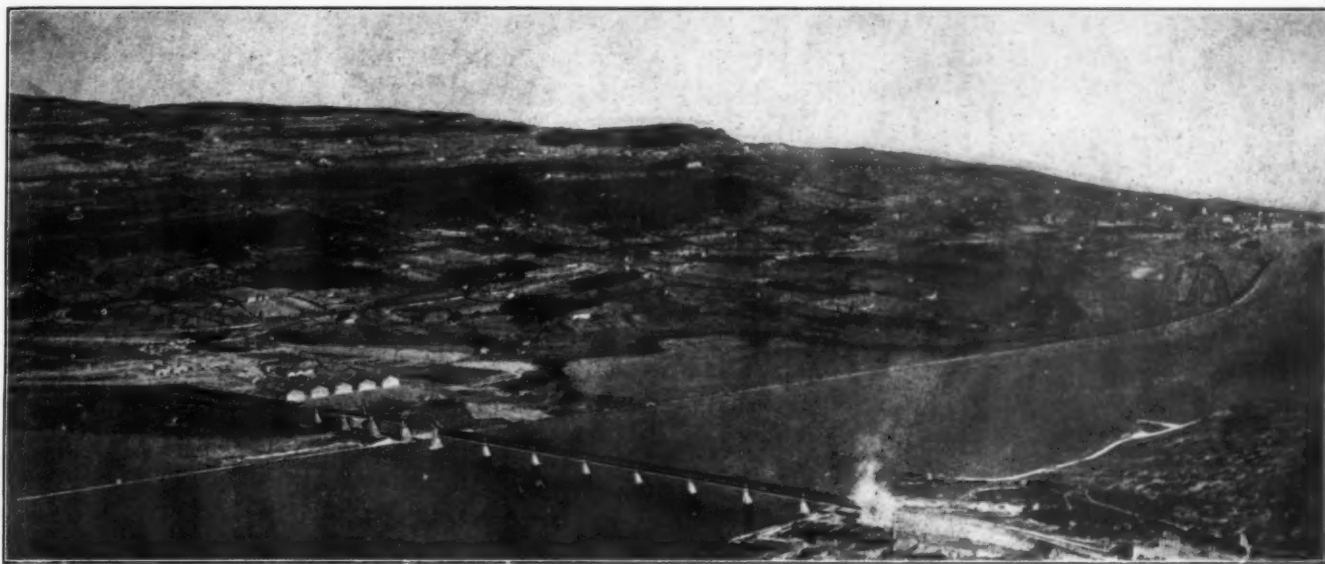
For the "Carmania" and the "Caronia," the details are the same, except that the plants are slightly smaller, in each case being two "Basex" units of 2 ft. 9 in. diameter with brine tank, steam jet elevator, water meters, and one 2 ft. 6 in. diameter pressure filter with steam jet agitator and air valve, the capacity being 560 gallons of zero hardness water per hour, and a total duty of 4,500 gallons between regeneration.

It may be stated also that "Basex" is a new base exchange water softening material (aluminium sodium silicate) that has only recently been placed on the market after a number of years' investigations and large scale experimental running, being a natural material, suitably graded and purified, and with a high degree of reactivity, and at the same time being of a resistant character so that no solution in the water takes place. Incidentally, also, the softening of water on these lines in marine work is of importance in connection with the supply for washing, shaving, laundry work, and similar uses on board ship, the fact that the equivalent of the temporary and permanent hardness going into the softened water as sodium sulphate and sodium bicarbonate respectively being no detriment under the circumstances.

Port Development at Marseilles.

The Present Extension Scheme and the Pre-War Plan.

By ROGER VEVER, Ing.E.C.P.



View of the Viaduct de Caronte.

INTRODUCTION.

THROUGH the courtesy of M.M. Bézault and Sainflon, the port managers, we are able to give the following particulars of development at the Port of Marseilles, and of the present extension scheme directed to cope with increasing trade.

Some idea of the increase in traffic is conveyed by the following figures:—

TONNAGE.				
1860	...	...	...	2,000,000
1880	...	...	...	4,000,000
1910	...	...	...	8,000,000
1913	...	...	...	9,000,000

PASSENGERS.				
1913	...	...	...	556,000
1921	...	...	...	680,000
1925	...	...	...	782,000

About half the passengers travel on the Corsica, Algeria and Tunisia lines.

Fruits and vegetables from North Africa ... 32,000 tons in 1925.

PRE-WAR EXTENSION PLAN.

In 1913 the quay accommodation was 15,000 metres; 600 tons were handled yearly per metre-length of quay. The Bassin du President Wilson, quayage of 2,600 metres, was then in course of construction. The port engineers had advocated the establishment of two more basins—Bassin Mirabeau and Bassin de l'Algerie, as shown on Supplement, to be completed within twenty years, and the total quayage would have thus been increased by 8,400 metres to 26,000 metres to cope with the estimated traffic of 16,000,000 tons for the year 1932. This figure was based on a yearly increase of three per cent.

The estimated cost was as follows:—Bassin Mirabeau, 123,000,000 gold francs; Bassin de l'Algerie, 124,000,000 gold francs.

The Bassin de l'Algerie was the first to be built, but the whole scheme was stopped by the War.

POST-WAR SCHEME.

In 1924 the Marseilles Chamber of Commerce, which body acts as Port Authority, asked for the alteration of the pre-war scheme, and Mons. Sainflon, a prominent port designer, was entrusted with the drawing up of the new plans which are analysed in this article.

NORTH EXTENSION.

BASSIN MIRABEAU.

The Bassin Mirabeau, as suggested in 1913 and shown on the Supplement, had three main drawbacks, namely:—

1.—The great size of the basin, in which strong winds would have created waves, thus interfering with cargo handling and the movement and safety of shipping.

2.—Too many bridges had to be spanned over the northern canals to give proper rail and road connections to the new wharves.

3.—The smallness of the berths; the seven 300 metre long quays accommodating only one 180 metre long ship each.



M. EMILE BASTOIN.

President of the Marseilles Chamber of Commerce.

Mons. Sainflon's plan figured out by the dotted line on the Supplement has entirely suppressed these drawbacks; the sea-wall is nearer the shore and the surface smaller, though an area 400 metres in diameter remains available for turning ships. Two piers, 175 metres wide, with a quayage of 500 metres, are provided for, the North Docks are to be 160 metres wide, and in the south of the basin, which has a breadth of 270 metres, either a big graving dock or oil wharves can be built.

The basin is sheltered by both the extension of the sea-wall and an entrance harbour 850 metres by 550 metres, connected with the canal in two places, thus linking the River Rhone to the Port of Marseilles.

Both the Mirabeau and Mourepianne dock systems have over-land connections with the shore, so that rail or canal traffic is not interfered with by bridges.

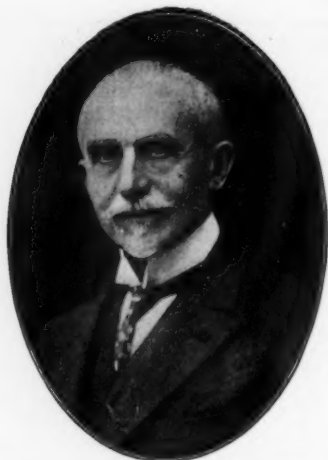
No quays are to be built alongside the sea-wall, because of the great expense of the construction and the difficulty of railway connection, but ships not using the berths may be moored there.

ESTIMATED COST.

The cost of 4,300 metres of quays and a wharf area of 55 hectares was estimated in 1924 at 338 million francs as against 354 million francs for a quayage of 2,900 metres and a wharf area of 48 hectares proposed in the pre-war plan.

The first step in the realisation of the Mirabeau scheme will be the construction of the sea-walls (coloured red on Supplement) for the purpose of sheltering the existing Bassin du President Wilson.

The estimated cost of this part of the work is 48,500,000 francs.



M. JULES BOURGOIGNON.
Chief Engineer Ponts et Chaussees.

SOUTH EXTENSION.

In the pre-war scheme, shown on Supplement, the Bassin de l'Algerie (quayage 3,710 metres, wharf area 32 hectares) had the following drawbacks:—

1.—Too great a water surface (85 hectares). The quay would have been 1,200 metres away from the sea-wall, and exposed to severe battering by waves created within the basin by strong winds.

2.—An elaborate rail connection which would have necessitated many revolving bridges.

The plan drawn up by Mons. Sainflon (see Supplement) is based on the following principles:—

1.—No wharf alongside the sea-wall, which is isolated from the shore and has purely a sheltering function.

2.—Building of entrance harbours made of slanting sea-walls.

3.—No bridges, but all piers connected overland to the shore.

4.—The establishment of a new railway system independent of the old one, which is inadequate for present traffic requirements.

The three basins are sheltered by a sea-wall 3,700 metres long and connected to the old basins, the reclaimed area enclosing the former sea-wall.

RAILWAY FACILITIES.

The engineers of both the Port and the P.L.M. Railway Company have together drawn up a railway scheme which will meet the requirements of new traffic.



M. LEON CHAGNAUD, Senator.

The building of the Gare du Canet and of the railway line, shown by a dotted line on the Supplement, would allow trains to be despatched either to Paris or Nice without going through Marseilles Station.

BASSIN DU PHARO.

The first step towards the realisation of the south extension scheme will be the building of the Bassin du Pharo, sheltered by a 1,775 metres long sea-wall and an entrance harbour.

The entrance channels are respectively 250 and 120 metres wide, and ships entering the docks will follow a 2,000 metres radius curve.

An area 150 metres wide is to be reclaimed on the west side of the Joliette sea-wall, to which three fish-tail piers, each 140 metres wide, will be connected, the width of the docks being 135 metres, as shown on Supplement.

The whole system of docks will be linked to the shore by the Traverse de la Joliette, as soon as the Bassin du Lazaret is connected to the Bassin du Pharo by the pulling down of the former sea-wall.

SEA-WALLS.

The Supplement shows a cross-section of the proposed sea-walls, of a type already successfully built in Genoa and now in course of construction in Algiers.

The wall is made of 500 metric ton artificial blocks, set 14 metres below the zero of the marine charts, and has already been used in Marseilles, as shown by the dotted line. The following advantages are claimed for this type of sea-wall:—

1.—Saving in time and money in construction.

2.—Smaller maintenance expenditure.

3.—The upright shape of the wall makes it possible to turn it into a quay wall if necessary.

4.—The smaller breadth of the wall makes the basin wider (15 metres in the case of the Bassin du Pharo).

5.—For linking one basin to another, gaps can easily be made in the wall by removing some of the blocks.

QUAY WALLS.

The quay walls will be made of 7.75 metres wide blocks of the required shape, the depth of water being 13 metres.

BASSIN DU PHARO.

The Bassin du Pharo will have a quayage of 4,200 metres, the surface of the reclaimed ground being 34 hectares and the water area 60 hectares.



M. GUSTAVE BEZAULT.
Inspector-General Ponts et Chaussees and Director of the Port of Marseilles.

SHEDS.

Fourteen one-storey sheds, 640 metres wide and from 150 to 200 metres long, covering 90,000 square metres of ground, are to be erected on the piers.

CRANES.

About one hundred cranes of a lifting power ranging from 1,500 to 3,000 kilogrammes, as well as a few of 5 metric tons, will do the cargo handling on the basis of four cranes for each 150 metres length of berth.

RAILWAY SYSTEM.

The docks system will be linked to the main line by a double track. Eight lines will be provided on each pier, two being laid alongside each quay and two on both sides of the main central road.

Close to the middle pier there will be a set of eight lines for shunting purposes.

ESTIMATED COST.

Entrance harbour 250 million francs (this sum does not include sheds or any other facilities). 2,500 metres long sea-wall, 36,000 francs per metre. South sea-wall (built in shallow water), 20,000 francs per metre. Quay walls 18,000 francs per metre. Sheds 50 million francs. Cranes 24 million francs. Railway facilities 6 million francs. Electric appliances 4 million francs. A total of 84 million francs.

ADVANTAGES OF THE BASSIN DU PHARO.

The ratio of water and ground surfaces is 1.80 as compared to 2.70 in the pre-war scheme (Bassin de l'Algerie).

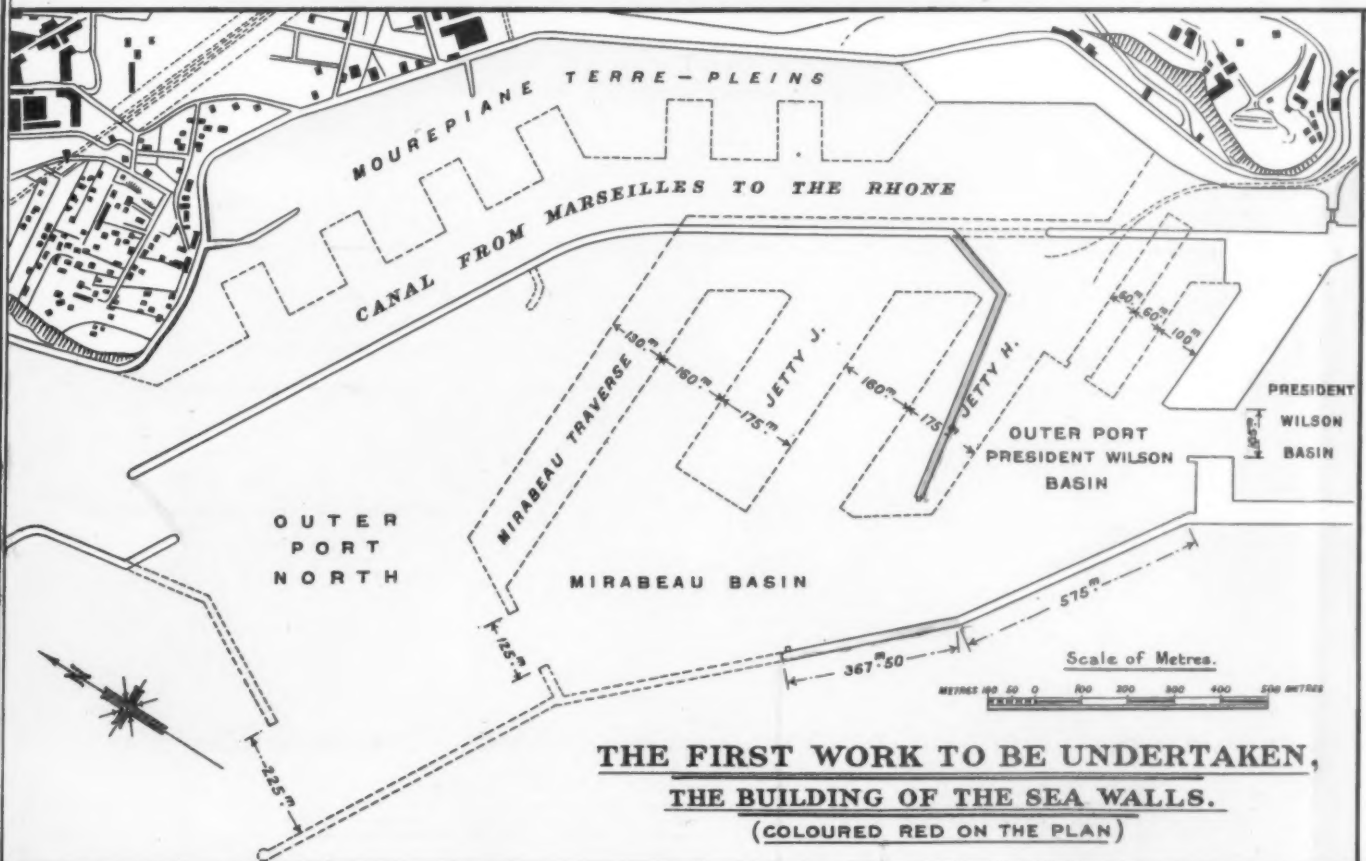
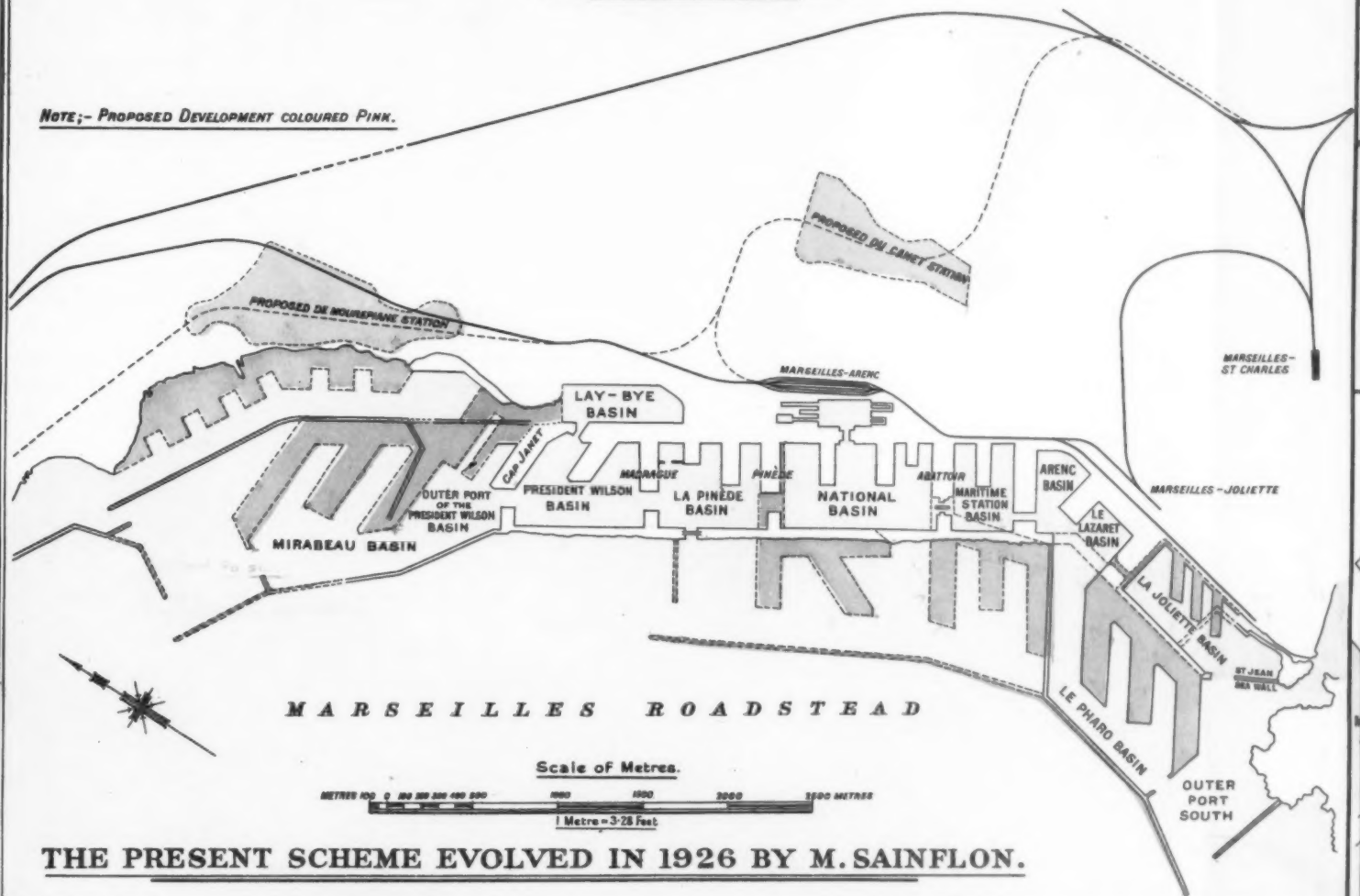
All wharves are connected overland to the main railway line, no turntables, but junctions being used.

PORT OF MARSEILLES EXTENSION.

(REVISED SCHEME OF DEVELOPMENT)

DIRECTOR;— M. BEZAULT.

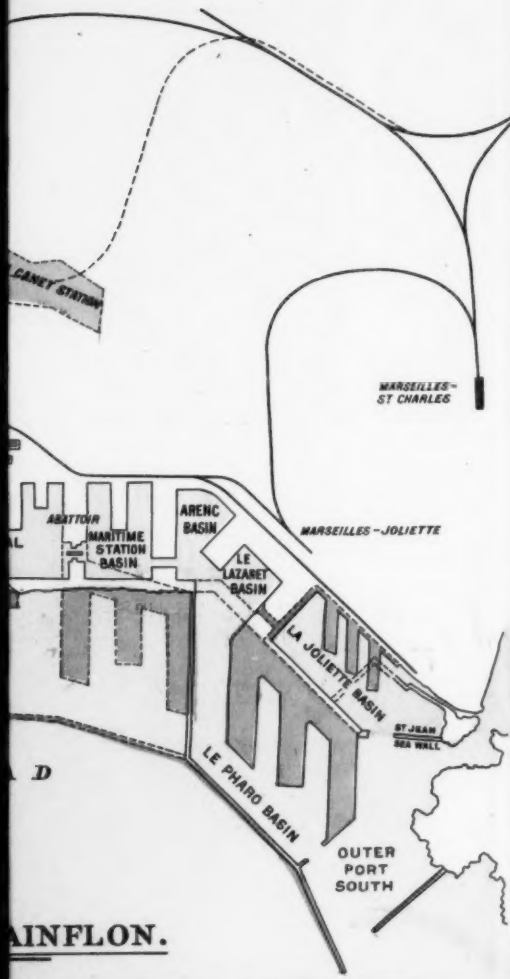
NOTE;— PROPOSED DEVELOPMENT COLOURED PINK.



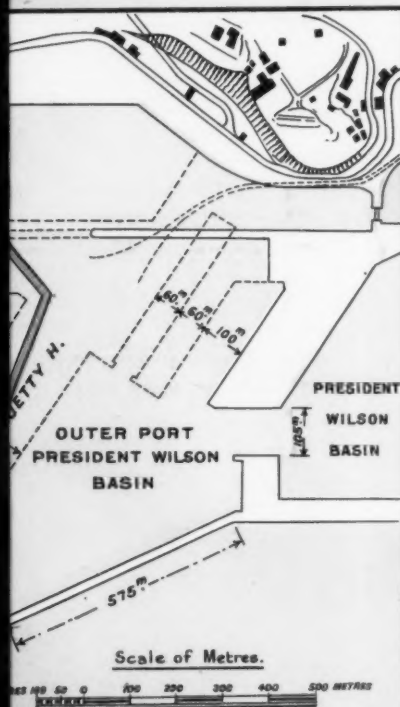
THE DOCK AND HARBOUR AUTHORITY

EXTENSION.

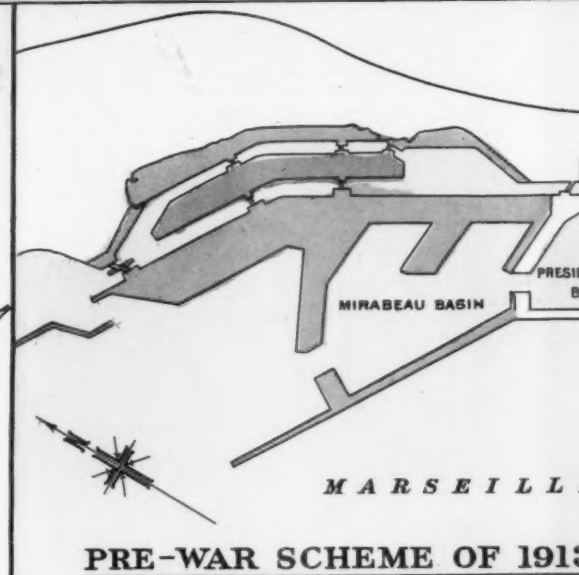
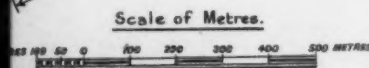
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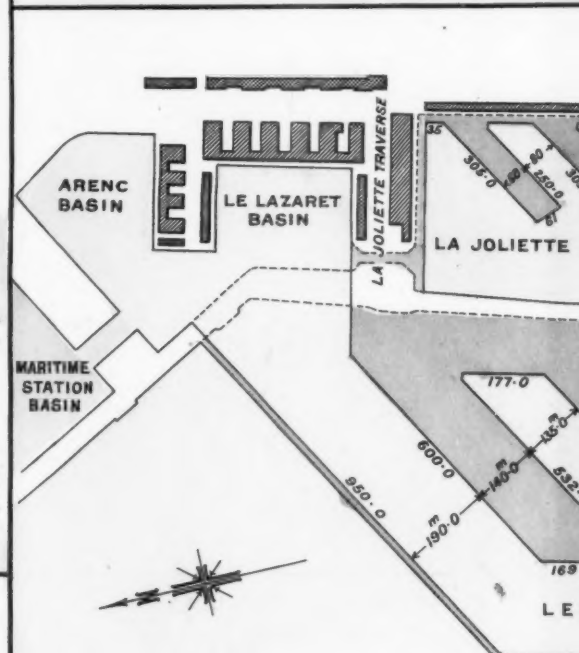
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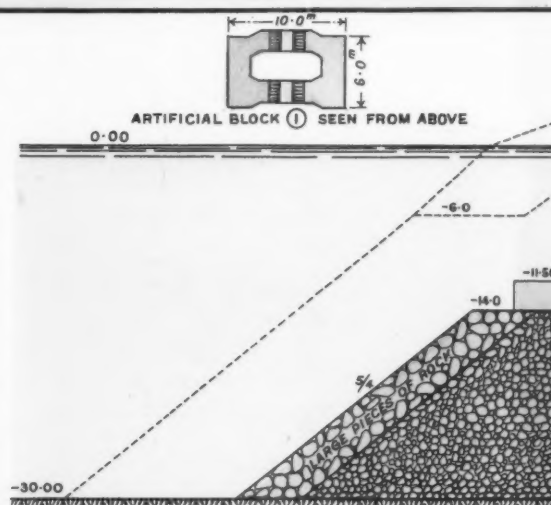
TO BE UNDERTAKEN,
THE SEA WALLS.
(ON THE PLAN)



PRE-WAR SCHEME OF 1913



LA JOLIETTE & LE PHARO BASIN



MARSEILLES-ARENC

MARSEILLES-ST CHARLES

MARSEILLES-JOLIETTE

LAY-BYE BASIN

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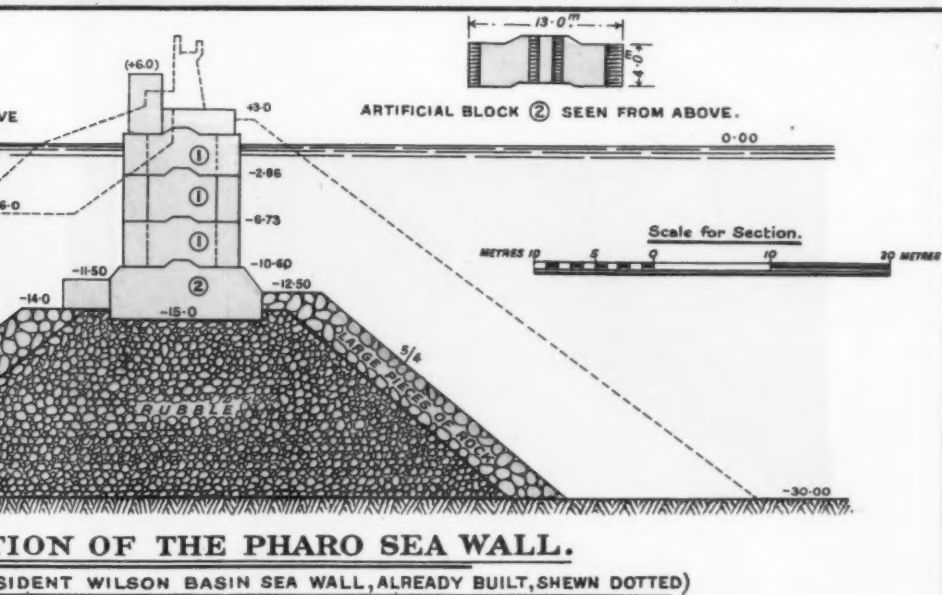
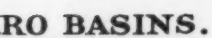
L'ALGERIE BASIN

MILLES ROADSTEAD

F 1913.

Scale of Metres.

METRES 0 500 1000 1500 2000



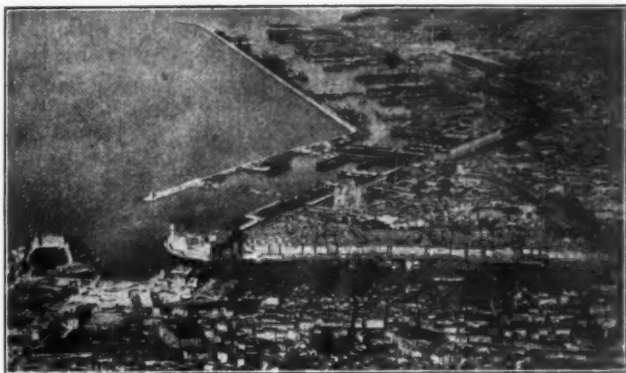
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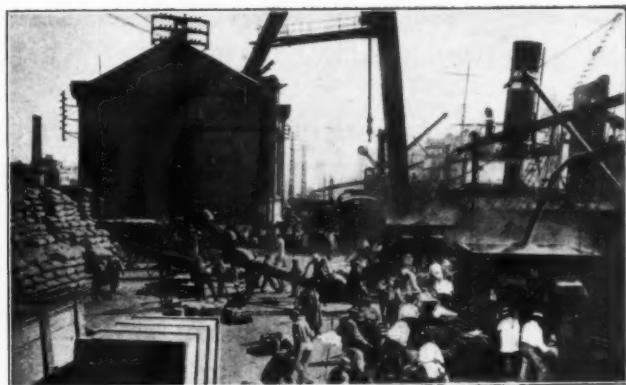
The Port of Marseilles.



Aerial View of the Port of Marseilles. In the foreground, the Old Harbour and the Joliette Basin.



The Town of Martigues and the Etang de Berre, which sea-going vessels will soon be able to enter.



Grain Traffic at Marseilles. Weighing, Bag-filling and Conveying Appliances.



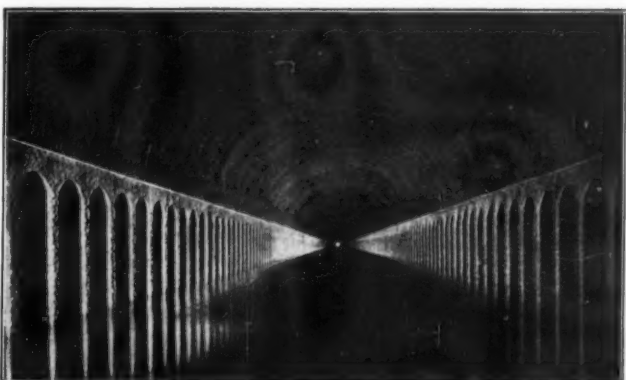
Marseilles Graving Docks. The largest one (on the left) is 215 metres long.



Pier E, One-storey Sheds, Total Floor Area 15,453 sq. metres.



Sheep from Algeria at the Port of Marseilles.



Marseilles to River Rhone Canal. Inside View of the Rove Tunnel, just recently completed. The South Entrance can be seen 7 kilometres away



Marseilles to River Rhone Canal. South Entrance of the Rove Tunnel. Length 7.200 kilometres, breadth 22 metres, height 15.40 metres above water level, depth 4 metres.



Joliette Basin, Corsica and Algeria Mail Boats.

Thanks to the new channel, boats will more easily reach the Bassins du Lazaret and d'Arenc.

BASSIN DE LA JOLIETTE IMPROVEMENTS.

The Bassin de la Joliette will be enlarged, its surface being increased from 22 to 33 hectares by the substitution of a new 300 metres long sea-wall for the old one as shown on Supplement.

It will be much more sheltered than at present. Three fish-tail piers 60 metres wide and 300 metres long are to be built 80 metres from one another, thus leaving a wide channel even when 15 metres wide ships and lighters are moored at two opposite berths. The basin will be large enough for turning most of the ships calling at Marseilles.



The Viaduct de Caronte.

SEA-WALLS.

The sea-walls of the entrance harbour will be constructed on the following process:—

Cement concrete caissons will be erected on land and then floated and sunk at the required place by filling them with lime concrete and spoil.

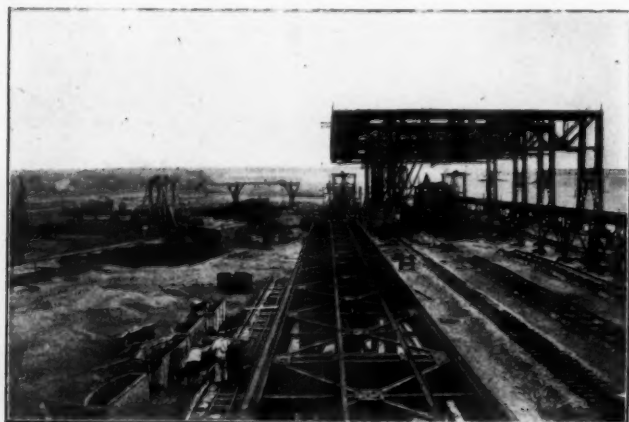
In the shallow parts of the Digue St. Jean the wall will be made of artificial blocks embedded in the bottom of the sea.

QUAY WALLS.

The quay walls will be made of moored artificial blocks having their foundation 8.50 metres below the zero of the marine charts; the depth of water will at first be only 8 metres except at the Corsica mail boat berths, where it will be 7 metres.

BASSIN DE LA JOLIETTE.

Each pier will be equipped with a one-storey shed; a second storey may be added later on, the ground floor, having a road



At work on the Quay.

10 metres wide and two railway lines alongside each quay.

On the first floor, besides a central passage and halls for passengers, there will be accommodation for imported vegetables and fruits.

Total floor area will be 5,000 square metres, not including open space for light cargo on flat roofs.

Cranes will be of the semi-portal type.

A passenger railway station would be built alongside the docks opposite La Place Joliette.

ESTIMATED COST.

52,000,000 francs for building the walls and reclaiming the ground. Ste. Marie sea-wall, 32,000 francs per metre. St. Jean sea-wall, 11,000 francs per metre. Quay walls, 10,000 francs per metre. Sheds, 16 million francs. Cranes, 12 million francs. Total for dock facilities, 30 million francs.

FIRST STAGES.

Work will at first be carried on in the south parts of the harbour, where are located passenger accommodation and the factories which provide two-thirds of the total traffic. The Bassin du President Wilson, on the northern side, will, however, be sheltered from land and sea winds as explained in the description of the Bassin Mirabeau.

The Marseilles Chamber of Commerce, judging the Bassin de la Joliette improvements works as urgent, decided, in March, 1926, under the chairmanship of Mons. Emile Rastoin, to pay 42,000,000 francs out of the total cost of 52,000,000 francs, the State's share in the expense being only 10,000,000 francs, which makes it possible, according to the Law of June 12th, 1920, to start work before an Act is passed by Parliament once the Minister's decree has been promulgated.

The Junior Institution of Engineers.

Calculating Apparatus and Diagrams.

Mr. A. P. Morris, in his lecture on "Calculating Apparatus and Diagrams for Engineers," at the Junior Institute of Engineers, London, on April 13th, kept well away from mathematics, for, he said, there was a vast difference between mathematics and calculation. The former demanded imagination, and the latter demanded none. Calculation was mechanical, and that was why a machine could do the work. The human brain could be trained as a calculating machine, which would work smoothly until it paused to think and then a jam would occur; it had to work unconsciously. In the seventeenth century, Pascal devised a calculating machine which was afterwards improved upon by other inventors and was still sold in one of its forms in Germany.

Modern attempts to revive Napier's bones and rods dated as late as 1905. A machine made by Leibnitz, in 1694, involved what was known as Leibnitz's wheel—a device which had been used extensively in later machines. Mr. Morris demonstrated two modern types of machines, one of which made use of wheels with teeth which could be varied in number by a perfect piece of mechanism, the other being of the type in which the action was produced by depression of keys bearing on a lever at different distances from its pivot. Neither of these mechanisms was new in principle, said Mr. Morris; the trouble was that it took a genius to devise a new mechanism and then a host of geniuses to make it fool-proof. Modern machines were guarded so that if wrongly manipulated they either refused to work or rang a bell.

Of the slide rule, Mr. Morris said that its advantages were that it was usually sufficiently accurate, and that it fitted the pocket in more senses than one! Against that, its constant use was a strain on the eyes, and there was trouble with it in damp climates.

BOMBAY CAISSON.

Messrs. Vickers-Armstrong's, Limited, have secured an order from the Bombay Port Trust for a ship-shape caisson for the Communication Passage between Princes and Victoria Docks, Bombay.

BLYTH HARBOUR IMPROVEMENTS.

New coal shipping staiths were opened at West Blyth on April 16th, increasing the capacity of Blyth Harbour from five to six million tons of coal per annum.

The substructure of the staiths was begun by the Harbour Commissioners in 1914, but owing to the War the scheme was not completed until 1919.

The superstructure built by the London and North Eastern Railway was finished in 1926, but a delay in being put into service arose from the coal dispute.

Two berths are provided, capable of loading ships of 500 ft. Each is equipped with gravity and telescopic spouts, and one has an appliance to prevent breakage of coal. The capacity is approximately 2,600 tons per hour, jointly.

Irish Harbour Matters.

CORK HARBOUR DUES REDUCED.

By fifteen votes to five, the Cork Harbour Commissioners have decided that the following reduced dues be put into operation:—Import: Wheat 1s. per ton. Export: Cattle (under two years) 5d. each; two years and upwards 1s. each; pigs 6d. each; sheep 4d.; horses 5s.; egg 2s. per ton.

PORT OF DUBLIN ACCOUNTS.

The Statement of Accounts for the Dublin Port and Docks Board for 1927 shows a gross revenue of £214,214 0s. 9d., a total expenditure of £189,955 13s. 7d., and a revenue surplus of £24,258 7s. 2d.

During the year, in accordance with the Board's decision to convert their short term Mortgage Bonds into Dublin Port and Docks Board 5 per cent. Redeemable Stock, the holders of bonds maturing were given the option of taking stock in exchange for bonds as they matured, and stock to the amount of £131,198 5s. 9d. was issued in this way, bringing the total issue of 5 per cent. stock at 31st December, 1927, to £539,430 11s. 2d. This stock is now listed as a Government security. Loans outstanding at 31st December, 1927, amounted to £1,142,595 6s. 5d., the balance to the credit of the various Sinking Funds at that date being £133,231 2s. 7d.

Mr. John P. MacAvin was co-opted to fill the vacancy caused by the regretted death of Mr. M. J. Moran in September, 1927. The late Mr. Moran had been a member of the Board since 1922.

On Monday, 2nd January, 1928, the following were elected, without opposition, as Traders and Shippers' members respectively:—

Traders' members.—George Byrne, John P. MacAvin, Patrick Munden, Wm. T. Watson. Shipping members.—David Barry, Philip J. Lawrence, Frederick McDowell.

The total registered tonnage which entered the Port of Dublin during the year, upon which dues were collected, was 2,271,856 tons, showing an increase of 209,210 tons as compared with 1926. In 1927, all coal imported, to the amount of 1,080,183 tons, came from across the Channel, while in 1926, owing to the miners dispute and the General Strike, 463,953 tons of coal came from abroad, the remaining 488,909 tons coming from the other side of the Channel.

Imports of general goods in 1927 from Great Britain totalled 468,957 tons, or 23,788 tons more than in 1926. There were 4,198 loads of timber imported from Britain in 1927 as compared with 3,506 loads in 1926. Of foreign timber, all kinds, 73,437 loads were imported as against 65,561 loads in 1926.

Under the heading of exports we also find indications of progress. Exports of general goods to cross-Channel ports show a total of 399,795 tons, as against 376,863 tons in 1926, while similar exports to foreign ports totalled 56,059 tons in 1927 as compared with 19,243 tons in 1926. Timber, all kinds, was exported across Channel to the extent of 13,534 loads, against 6,187 loads in 1926.

All live stock exports via Dublin, with the exception of horses, and eliminating 1924, which was an abnormal year for the Irish live stock trade on account of foot and mouth disease in England, continue to show a gradual increase. In 1923 cattle exports from Dublin numbered 240,862 head; in 1925 they numbered 318,972; while last year's total was 359,710. Sheep exports in 1923 numbered 168,719 head; in 1925 they stood at 226,448 head, while last year the figures were 354,898. Pig exports in 1923 numbered 116,747 head; in 1925 they had fallen to 25,892; but in 1927 they had increased to 103,477. This was in all probability due to the increasing demand from the other side of the Channel for porkers. The exports of horses, etc., fell from 6,816 head in 1925 to 4,072 in 1927.

A study of the registered tonnage that entered the Port of Dublin shows that the overseas trade was represented by 557,128 tons, of which 548,748 were steam and 8,380 sail. In 1925 it was 529,610 tons. In 1926 the overseas tonnage was 736,381, the highest figure reached since 1885. Of this immense total, 733,705 tons were steam vessels, many of which were employed in carrying fuel from abroad.

The income derived from tonnage dues, timber, etc., rates in 1926 amounted to £79,838 13s. 11d., while in 1927 it amounted to £79,650 4s. 11d. The tonnage duty on overseas trade in 1927 amounted to £22,869 6s. 11d., and on coasting trade to £56,780 18s., as compared with £33,235 10s. 2d. on overseas trade and £46,603 3s. 9d. on coasting trade in 1926. The total tonnage of coasting vessels which entered the port in 1927 was 1,714,728. The bulk of these were steam coasters and steam colliers, with 3,764 sailing coasters and 208 sailing colliers. In 1926 there were only 76 sailing colliers, and, in the two previous years, none.

A DOCKYARD LAUNCHING.

The Dublin Dockyard Co. (Messrs. Vickers (Ireland), Ltd.), having built three ships for New Zealand, has launched "The Isolda," the latest addition to the fleet of lightship tenders for the Irish Lights Commissioners. Her dimensions are 190 ft. in length by 32 ft. in breadth, and 15 ft. 9 in. in depth (moulded). Her speed will be slightly over 12 knots. Her equipment

includes special gear for lifting and repairing mooring buoys. She is also fitted with an automatic towing winch. She is of steel to Lloyd's highest class. Her machinery will consist of two sets of triple expansion engines, steam being supplied by two single-ended Scotch boilers, fitted for oil fuel.

The vessel has been built to the design of Mr. George Idle, naval architect to the Commissioners of Irish Lights, and Mr. George M. F. Gray, who is responsible for the engine work.

The Grand Canal Co., Dublin, has ordered the building of twelve barges from the Dockyard Co., and an order has also been placed by Messrs. Guinness.

THE LATE MR. JOHN HOLLWEY.

By the death of Mr. John Hollwey at his residence, Cabin-teely, Co. Dublin, in February, the Dublin Port and Docks Board has lost a member who was on three occasions elected chairman, a record which shows how much he was appreciated by his colleagues. He carried on business as a shipbroker and timber merchant in Dublin under the title of George Bell and Co. He was also a member of the Executive Committee of the Dock and Harbour Authorities' Association, London, as a representative of the Dublin, Cork and Limerick Harbour Authorities. These meetings in London he attended regularly.

He is succeeded by his second son, Major J. B. Hollwey, who served in the War, retired, and joined his father in the business. He has now been co-opted a member of the Dublin Port and Docks Board in the place of his father. Mr. Hollwey's eldest son died from the effects of wounds and disease contracted on active service.

NEW DOCKS CHAIRMAN.

Mr. P. J. Lawrence, the new chairman of the Dublin Port and Docks Board, is managing director of the Irish American Oil Co., and has been associated with that company for the past 28 years in Dublin. He is a past president of the Dublin Rotary Club, and last year was on the Council of the Chamber of Commerce. He has been a member of the Dublin Port and Docks Board for the past six years, and for two years acted as vice-chairman.

At a recent meeting of the Board Mr. Lawrence mentioned that at the Alexandra wharf there were about 850 ft. of wharf to be replaced at an approximate cost of £100 per foot. This would involve a capital expenditure of £85,000. Last year the engineer had been given authority to reconstruct 100 ft. annually. At this rate it would take eight and a half years to complete the work. This, in view of the present condition of the wharf, was a futile arrangement. He suggested that the work should be done at the rate of 200 ft. per annum. The Finance Committee agreed to this course and that the work be continued until completed.

BELFAST IMPROVEMENTS.

The Belfast Harbour Commissioners have decided to carry out several improvements. These comprise:—

The laying of a concrete track down the centre of the Northern sections of the Donegall Quay sheds—i.e., from Clarendon Dock entrance to the south end of Albert Quay.

The laying of a concrete tank (15 ft. in width) in Clarendon Graving Dock Yard, from No. 1 Shed to the main gateway at Corporation Street, and along the north side of No. 2 Graving Dock.

The improvement of the approach to Dee Street Bridge by the provision of two square-settled tracks, i.e., one on either side of the roadway, with a concrete track in the centre. Apart from increasing the number of facilities these schemes will absorb a number of unemployed men.

BELFAST SHIPPING FIGURES.

Official figures of vessels arriving in Belfast from the 1st July to the 31st March, show—Coastwise and cross-Channel, 559,446, an increase of 38,570 over the corresponding period of last year; foreign 151,901, a decrease of 6,777; non-trading 23,182, an increase of 2,119—total 734,529, an increase of 33,912.

BELFAST'S CHAIRMAN.

Mr. R. E. Herdman, D.L., has been elected the Chairman of the Belfast Harbour Commissioners for the third year in succession. Mr. Herdman, who is one of the leading business men of the city, has been a member of the Board for almost 25 years, and striking tributes were paid to him by several of his colleagues at the meeting at which he was re-elected Chairman.

SHIPPING SERVICES.

The shipping facilities provided by the Burns-Laird Line and the Belfast Steamship Co. for Londonderry were criticised at a meeting of the Derry Chamber of Commerce. A resolution was passed requesting these Companies "in view of the unsatisfactory conditions prevailing for passengers and goods," to restore immediately the pre-war services between Londonderry, Glasgow and Liverpool, and to reduce the fares and freights.

Mr. Frank Gilliland, who raised the matter, said he made no criticism of local management. After contrasting present con-

ditions with those of pre-war, he said that the policy seemed to be to keep up freights and fares, sell off all boats they possibly could, and build no new ones. Criticising the goods service, he said it took a consignment of galvanised iron, ordered from him, twelve days to come from Chester. Steamers had more cargo than they could cope with, and goods were allowed to lie at Liverpool Quay. The fares were double those in pre-war days, and should be reduced.

The other side of the question was put by Mr. William McCarter, local agent of the Burns-Laird Lines and the Belfast Steamship Company, who said Derry had suffered less in the way of reduced services than any other port. Belfast had 18 sailings per week pre-war, to Scotland; now it had 11. Dublin had seven sailings pre-war, and now 4.

Londonderry, which had six sailings per week pre-war, now had daily sailings, and very seldom had less than four. Even the railway companies, with all their large resources, had been forced to curtail their services, and at the end of April the long-established service between Belfast and Fleetwood would cease. The subject dropped.

NEWRY HARBOUR.

The Joint Committee of the Newry Urban Council and the Newry Harbour Trust asked the Belfast Harbour Commissioners to allow the Engineer to go to Newry and assist in connection with a scheme for deepening the tidal river there. The Commissioners agreed to their Engineer giving the assistance required.

HARBOUR DUES REDUCED.

Replying to a vote of thanks for his services as chairman of the Dublin Port and Docks Board in 1927, Mr. T. McCullagh said that the Board had reduced the dues by 12½ per cent. as from the 1st June last. Notwithstanding this reduction, the surplus was somewhat the same as the previous year. The Board had a substantial reserve in surplus revenue, and he was sure that the question of a further reduction in taxation would be borne in mind.

Funds have been arranged to meet the redemption of any short term loans falling due, and which the holders do not wish to convert into the Board's 5 per cent. stock, which has been approved as a guarantee security. The upkeep of the Port has been fully maintained, and the financial position of the Board continues satisfactory.

PROPOSED LIMERICK EXTENSION.

That Limerick is the only port in Ireland that has a floating dock, and the only port in the West of Ireland that has a dry dock, was stated in evidence before the Ports and Harbours Tribunal by Mr. J. F. Power, secretary, Limerick Harbour Commissioners. In view of congestion at the docks and to provide for larger vessels of heavier draft, the Limerick Harbour Act, 1926, was passed without opposition. The lowest tender for the proposed extension, said Mr. Power, came from the Netherlands Harbours Works Company, and amounted to £138,938. The Board, he said, is now free from debt, and has £29,000 invested in Government securities, as well as over £3,000 to credit in bank. The Board is now in a position to carry out its engagements and to recoup the Government for the construction of the light railway at the same interest that was charged in respect of the Shannon power scheme. Deducting the amount paid in dues by Messrs. Siemens Bau-Union, there is a surplus revenue of £1,100.

Compared with Cork, Dublin and Waterford, it is claimed that Limerick dues, in the great majority of items of import, are much lower.

A statement of accounts for 1927 issued by the Limerick Harbour Board shows that 427 vessels, with a net registered tonnage of 234,398 tons, entered the port. This is an increase of 79 vessels and 38,692 tons. Income from all sources amounted to £28,443, an increase of £4,597. Ordinary expenditure amounted to £13,926, leaving a balance of £14,000. The Board had no liabilities and had invested in Free State 5 per cent. and British 5 per cent. War Loan, £29,507. There was a credit balance at bank of £3,786.

It appears that last year 6,900 tons were shipped from Limerick, compared with 2,311 tons in 1926.

WICKLOW HARBOUR DUES.

Before the Rates Advisory Committee in Dublin Castle on the 20th March, the Wicklow Harbour Commissioners applied for an Order under the Harbours, Docks and Piers (Temporary Increase of Charges) Act, 1920, authorising an increase in their statutory maximum charges.

Mr. Davis, secretary to the Harbour Commissioners, said that they proposed to raise their port charges as follows:—

Timber from 3d. to 6d. per ton; coal from 3d. to 6d. per ton; manures from 4d. to 8d. per ton; feeding stuffs from 4d. to 7d. per ton; every vessel (loaded) from 6d. to 8d. per ton; vessels (unloaded) 4d. to 6d. per registered ton; Scotch fishing boats, 10s. for shelter from 1s.; season fishing boats (Howth boats), 5s. each from 1s.; burnt ochre 2d. to 3d. per ton.

It is estimated that these increases are necessary to meet the liabilities of the Commissioners. Local merchants are agreed as to their necessity.

A Belfast Launching.

The Shallow Draft Tanker "Hooiberg."

Messrs. Harland & Wolff, Ltd., successfully launched, on the 27th March, from their East Yard, Belfast, the s.s. "Hooiberg," a shallow draft oil tanker which is being built to the order of Messrs. Andrew Weir & Co., for the Lago Shipping Company. The "Hooiberg" is the third of five similar vessels ordered from Harland & Wolff, Ltd., and is classed 100A1 at Lloyd's, being specially designed for carrying petroleum in bulk. The principal dimensions are, length 315 ft., breadth 50 ft., gross tonnage about 2,360.

The vessel has a straight stem and elliptical stern, and is rigged as a one-masted fore and aft schooner. The quarters for the captain and officers are well furnished in mahogany with curtains and upholstered settees, and comfortable accommodation on the poop deck has been arranged for the engineers and other members of the crew.

There is a derrick about 40 ft. long for 5-ton lifts, arranged to ship on either fore or after side of a derrick post amidships, operated by a steam winch. A steam warping winch is situated on the poop deck aft.

The electrical installation consists of two 5 k.w. dynamos, direct coupled to an enclosed high-speed forced lubrication engine. These two sets supply the electric power required for 95 lights distributed throughout the ship, including a 600 c.p. ½-watt lantern in the machinery space, and a Morse signalling lantern on the bridge.

The vessel is propelled by engines of twin-screw triple expansion type, developing 1,100 h.p., steam being generated in two cylindrical, single-ended boilers, each boiler having three Morison furnaces fitted to burn oil fuel on White's System under natural draught, the working pressure being 180 lbs. per square inch.

Kiel Canal Traffic.

February Figures Reflect Brisk Movement.

A report received by the Department of Overseas Trade from the Acting British Consul-General at Hamburg, states that shipping traffic in the Kaiser Wilhelm Canal during the month of February was very brisk. The canal was used by 3,240 vessels, aggregating 1,080,198 net registered tons. There was an increase over the same period of last year of about 100 vessels and some 160,000 net registered tons. The increase is the more remarkable since the winter was considerably more severe than that of the preceding year. In spite of this, traffic has increased this year.

Of the 3,240 vessels constituting the total traffic, 1,699 were registered as seagoing steamers aggregating 943,327 net registered tons, and 28 as seagoing motor vessels aggregating 28,976 net registered tons. Of these vessels 1,436 were cargo and passenger steamers aggregating 939,478 net registered tons, 136 tugs aggregating 4,356 net registered tons, and 105 steam trawlers aggregating 7,480 net register tons; in addition to these there were 1,348 sailing vessels aggregating 68,922 net register tons, and 165 lighters and barges aggregating 38,973 net registered tons. The vessels were loaded as follows:—

Four with passengers; 131 with coal; 59 with stone; 40 with iron; 90 with timber; 48 with grain; 18 with cattle; 577 with ore and other goods in bulk; 903 with piece goods; 69 with general cargo; 860 (25 per cent. of the whole traffic) empty or in ballast.

The cargoes increased in proportion to the general increase in traffic, the increase being specially noticeable in shipments of grain, ore and stone. There was, however, a decrease in wood and coal cargoes. The big increase in steam-trawler traffic in the canal is especially noticeable. The sailing vessel navigation in the Kaiser Wilhelm Canal increased during the month by some 100 per cent. owing to the improved ice conditions.

Personal enquiries regarding all shipping and transport matters should be made at the City office of the Department (Shipping and Transport Section), 73, Basinghall Street, London, E.C.2.

Tenders Invited.

LIGHTERS FOR CONSTANTINOPLE.

The Commercial Secretary at Constantinople (Colonel H. Woods, O.B.E.), reports that a Constantinople Company are calling for tenders, to be presented by the 3rd May, for the supply of water carrying and other lighters as follows:—

Four steel motor-driven water-carrying lighters, two of 80 tons capacity and the remaining two to contain 35 cubic metres of water each. Two 100-ton lighters. Two 50-ton lighters. Two 25-ton lighters. Two 15-ton lighters.

Firms in a position to offer British-built vessels can obtain further particulars on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. (AX 6188.)

Prince Rupert Harbour.

A Growing British Columbian Fishing Port.

INTRODUCTION.

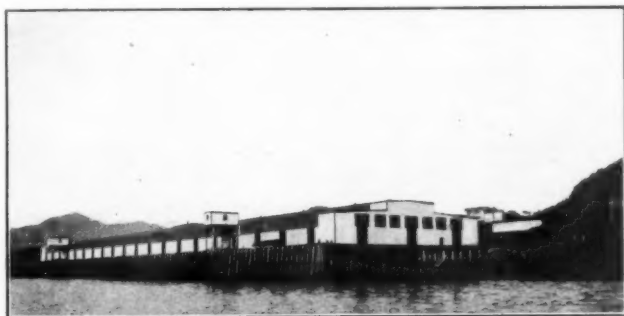
Possessing a large and commodious harbour, covering an area of about 10 miles in length from a half to two miles in breadth, Prince Rupert as the northern terminus of the Canadian National Railway, principal port on the northern coast of British Columbia, and in the heart of an enormous salmon and halibut industry, has many factors contributing to its importance. The railroad line which has played a prominent part in the development of the port, connects Prince Rupert with the entire railroad system of Canada and the United States.

Other industries, which are adding force to the great progress which Prince Rupert has been making for several years past, are, mining throughout Central and Northern British Columbia and forestry in the hinterland, the product of which find an outlet at the port. This is also a grain outlet for Saskatchewan and Alberta, the Dominion Government elevator now being under lease to the Alberta Wheat Pool. The port is 500 miles nearer the Orient than any other terminal port on the Pacific Coast, and two days nearer the Yukon and Alaska than any other Pacific Coast city.

Large shipments of lumber, poles, railway ties, silver, gold, copper blister, shingles, fish and raw furs are made through this port. It is in the centre of the "Big Sitka Spruce" district.

The fishing industry is of first importance and has been developed on a large scale. The official name of the fisheries is the "Skeena River District" or "District No. 2," and embraces the Skeena River, the Naas River, Queen Charlotte Islands and adjacent waters situated between. Prince Rupert is practically located in the centre of the entire fishing grounds.

Considering the Skeena No. 2 District as a whole, salmon fishing predominates, but halibut fishing is more important to Prince Rupert.



New Ocean Dock at Prince Rupert, British Columbia.

Prince Rupert is the greatest halibut port on the Pacific. The Skeena River entering the ocean a few miles south of Prince Rupert is the most productive salmon river on the Pacific Coast. A dozen canneries are located on that river and as many more adjacent to its mouth. The largest fish cold storage plant in the world is at Prince Rupert.

The population of the city is about 8,000. The latitude of Prince Rupert is 54 deg. 17 mins. north, longitude 130 deg. 20 mins. west, about the same latitude as Liverpool, England, and has a climate the mean temperature of which is the same as that of the great shipping port of the Mersey.

Wet season extends from October to March. Dry season from April to September. Precipitation sometimes reaches 95 ins. Coastal climate mild. Flowers bloom outside all through some winters.

The harbour and contiguous waters are absolutely clear of ice and floes at all times. There are no dangerous currents, no fog in winter and navigation is never impeded through weather conditions.

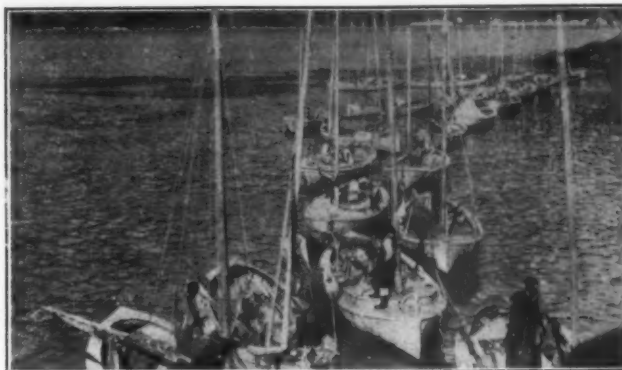
NATURAL HARBOUR.

The natural harbour is completely landlocked, with good holding ground for anchorage. The maximum rise of tide is 21 ft. and the minimum fall is 20 ft.; mean range of tide is 17 to 18 ft.; minimum depth of anchorage at low water 15 fathoms. Vessels anchor 50 to 800 ft. off shore. The approach to harbour is easily accessible, with lights and buoys provided. Pilots are available but not compulsory. After a navigator has once entered the harbour he can enter afterwards without the aid of a pilot. The distance from the docks to the ocean is 30 miles. There is a wireless station capable of communicating with stations 500 miles distant, also a quarantine station and docks.

The Dominion Government maintains a Biological Research Station at Prince Rupert.

The coastal steamship services all call to the port and there is a daily train service to the East, and from the East. The Canadian Customs procedure is such that ships can clear to any port in the world.

There are eight wharves, comprising: Canadian National, with 800 ft. warehouse, electrically equipped and with electric



Salmon Fishing Fleet, Prince Rupert.

gantry cranes. Provincial Government wharf, 500 ft. long, of wholly reinforced concrete construction, with two-storey warehouse and offices. Imperial Oil Co.'s Wharf, Union Oil Co.'s Wharf, lumber assembly wharf and others, making a total wharf frontage of some 4,000 ft. in addition to the elevator wharf.

The Imperial and Union Oil Companies have large storage capacity for oil. The depth of water at all wharves is 35 to 40 ft. at low tide.

The city has a first-class hospital with fully-equipped operating theatre, X-rays, etc.

The Canadian National S. S. Co. operates one of the largest dry docks in America, with a capacity of 20,000 tons and a length of 600 ft., with a fully-equipped marine repair shop and shipbuilding plant in connection. The dock is in three sections. It should be noted that stone or gravel ballast is always available.

There are first-class electric light, telephone and water plants owned and operated by the municipality.

The city is run on the single tax system, with no tax on improvements.

SALMON CANNERIES.

There are 15 canneries in the vicinity of Prince Rupert. One of the most modern is located at the upper end of the harbour.

A NATURAL OUTLET.

Prince Rupert is the logical outlet for the grain and other products of the Peace River district of Alberta and British Columbia, as well as for the already-developed portions of the prairie provinces.

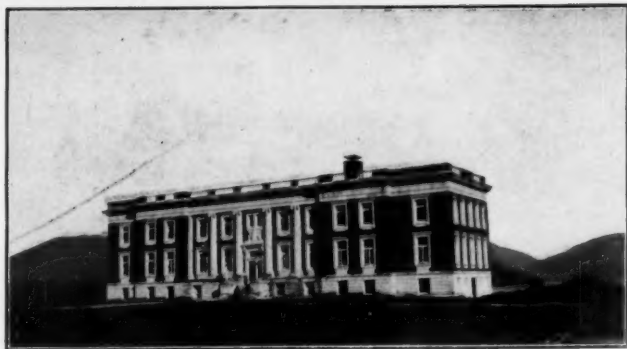
In order that the facilities of the port and town may keep pace with the general expansion in all lines of commercial activity that has been taking place here, the Dominion Government has constructed a modern elevator of one-and-a-quarter million bushels capacity. The elevator is of steel and reinforced concrete construction. The unit comprising the storage tanks measures 277½ ft. in length and over 68 ft. in breadth; the workshop is 62 x 94 ft., and the car unloading shed is 101 ft. by 58½ ft. The storage capacity of 1,250,000 bushels is divided amongst 130 tanks of varying sizes. The 36 largest of them can hold 25,000 bushels each; 24 can handle 6,000 bushels each; 22 are of 5,000 bushel capacity; 15 of 3,000 bushel capacity and remaining storage units are constructed to hold 1,200 bushels each.

The receiving capacity of the house is 18 car loads per hour, and the shipping capacity is 50,000 bushels per hour. There are 12 grain cleaners, which make it possible to clean 15,000 bushels per hour. These are Monitor wheat cleaners. A drying of 1,000 bushels per hour is afforded by a Morris grain drier.

The regular grain equipment includes two 9a Monitor scales, two high Carter disc machines and one single Carter disc. Clarke automatic shovels are used for unloading. There are five 2,000 lbs. Gurney scales. Electricity is used for power and light. There are 45 electric motors with an aggregate 1,327½ h.p. A 400 ft. Morse silent chain drive is used in connection with the power installation. There are 26 belt conveyors in the house, representing a total length of 13,000 ft., ranging in width from 16 to 40 in.



Whaling Gun in action near Prince Rupert.



Provincial Building, Prince Rupert.

The wharf in front of the elevator is 1,000 ft. long. There are 19 grain spouts on it. It is protected with a fire hose every 150 ft., and there is 35 ft. depth of water at low tide.

In the matter of marine insurance, Prince Rupert is on a parity with other large Pacific seaports, being excluded from the North American Warranty.

Northern British Columbia lands have been held back from development through lack of transportation facilities. It is a well-known fact that the great interior valleys contain immense areas of good agricultural lands easy to bring under cultivation, and whenever a railway is built to tap the Peace River country it should also serve to open up these lands.

The shortest route of all from Pouce Coupe to the Pacific Coast is the one by way of Peace Pass and Finlay Forks. It traverses a rich country and opens up a greater fertile area than any other route.

Whatever route is adopted should be one that will benefit the Peace River people and what they want are the best possible rates to the coast. As Prince Rupert is nearer than any other point, if the proper route is adopted, the railway that would benefit Peace River most would be one of those giving the most direct route to tidewater. If in so doing it can open new fertile lands it will have a double advantage. All this is attained by choosing one of the routes through British Columbia.

In 1926, the inward traffic comprised 3,604 vessels of 936,476 tons, and the outward traffic, 3,711 vessels, totalling 923,981 tons.

FISHERIES.

The great essential in the fishing industry is the speedy marketing of the fish after it is caught. The quicker fish is placed on the market, the better the quality obtained by the consumer. Prince Rupert, being the terminus of a trans-continental railway, and 500 miles nearer the fishing grounds than any other railway port, is where the fishermen bring their catches.

There is a great future for the cod and herring fishing business, which up to the present time has scarcely been touched, most of the fishermen confining their operations to the halibut and salmon.

Valuable herring fishing grounds are within easy reach of Prince Rupert, which provide ample quantities of bait for the halibut fishing industry and also for salting and smoking purposes.

The Prince Rupert Marine Products, Ltd., is operating a fish bye-products plant at Tucks Inlet, in Prince Rupert Harbour, and from the fish refuse it collects from the Canneries and the fish-packing depots manufactures oils, fish meal for poultry and cattle, and fertilizer.

In the North Pacific the halibut and salmon are the only fishing industries that have been earnestly prosecuted to any magnitude on a commercial basis. There are several other species of edible fish abounding in this ocean, and the possibility of their being commercialised is receiving the attention of the Biological Experimental Station at Prince Rupert.

FISH CATCH.

The figures of the 1926 catch for this district were as follows:

	lbs.	Value \$
American Halibut	20,597,500	2,702,165.00
Canadian Halibut	7,021,600	873,439.00
Canadian Salmon	110,994,752	5,016,242.00
American Salmon	893,700	86,646.00
Canadian Cod	169,600	6,469.00
American Cod	284,200	11,942.00
Soles	105,000	1,312.00
Flounders	5,600	70.00
Canadian Herring	1,703,500	21,034.00
American Herring	152,000	1,702.00
Crabs	13,300	1,064.00
Shrimps	3,800	570.00
Clams	422 bbls	1,266.00
Whales	269	260,127.00
		<hr/> \$8,984,048.00

Salmon canned in the district approx. 1,268,028 cases; represents about 103,000,000 lbs., and value in manufactured state, \$13,552,875.00 (approx.).

The 1925 value in raw state was \$4,182,327.00, and of canned salmon about \$9,984,669.00.

COLD STORAGE PLANT.

The Canadian Fish and Cold Storage Company's plant is the largest fish cold storage in the world, and the fourth largest of any description in Canada. It operates 12 months of the year and has an annual pay roll of \$300,000.00. It handles about 20 million pounds of fish yearly, and the constantly increasing output of the plant shows that the food value of fish is steadily becoming more and more widely recognised. The varieties handled are: fresh and frozen fish—halibut, red spring salmon, coho salmon, pink salmon, steelhead salmon and qualla salmon, black cod, red cod and ling cod, brills, soles, flounders, skate and herring, smoked fish, kippered herring, bloaters, black cod and salmon of all grades. Salt fish—cod, herring and salmon of all grades. The company owns a fleet of fishing vessels and the plant is electrically operated.

The cold storage occupies a building of six storeys, containing 781,000 ft. of refrigerator space, and is equipped with three ice tanks. It can manufacture 100 tons of ice daily, and has an ice storage capacity of 2,000 tons, apart from the main cold storage building. Its cold storage capacity is 7,000 tons. Many interesting freak fish are to be seen here, and some giants. Among the latter is a halibut that weighs 346 lbs. with its head off and many others that tip the scales at 250 lbs. and over.

AGRICULTURE.

Farming is the staple industry in the great valleys contiguous to Prince Rupert. Along the line of the C.N.R. great strides have been made in grain growing, timothy seed production and fruit and mixed farming, while an additional source of revenue is found by many settlers during the winter months, when agricultural operations are lightest, in the production of poles and railway ties either from their own uncleared lands or other timber limits.

Terrace is the centre of the fruit belt, success having been attained there in the growing of small fruits, especially strawberries, and also in growing apples, pears, plums and cherries. Other fruit valleys are the Kitsumkalum, Lakelse, Bella Coola and the Naas.

About 150 miles east the country and climate change and the soil is more suitable for grain growing, timothy seed production and mixed farming.

Smithers is the principal town in the Bulkley Valley, and it is a divisional point on the line of the C.N.R.

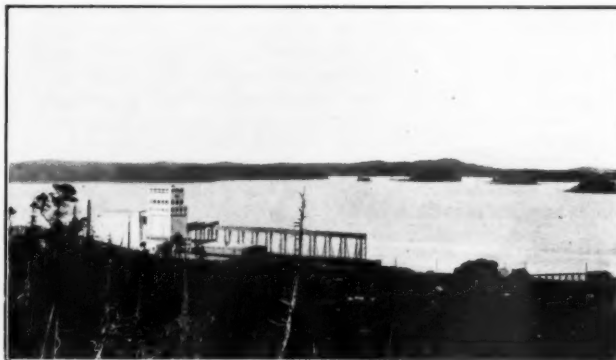
The building and operating of an elevator at Prince Rupert has resulted in a much greater acreage of grain being grown in Central British Columbia.

The production of timothy seed is increasing by leaps and bounds. The Department of Agriculture have installed power seed cleaning plants at Smithers, Barrett and Burns Lake. During 1925 only 45 tons of seed were shipped, in 1926 the quantity was increased to 275 tons. The farmers receive a very high price for this seed as it is of a very superior quality.

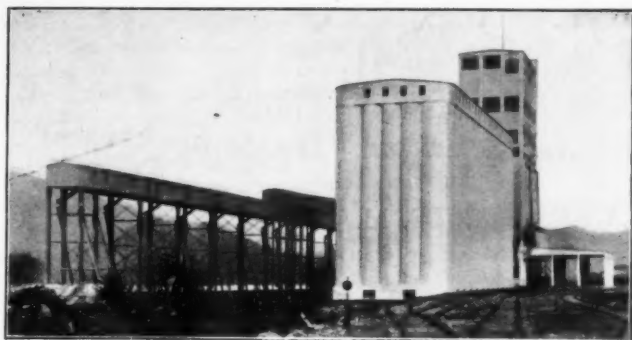
Climate varies as to district. The Coast as far east as Mile 90, mild; East from that point, dry climate with hot summers, and fairly cold winters, no extremes; snowfall is light, and brilliant sunshine the rule. It is a remarkable fact that storms and blizzards are practically unknown in this belt.

The Dominion Government is contemplating opening an experimental farm in the Lakes District. There are good schools, roads and stores, and in most places telegraph and telephone, with regular mail service.

The Queen Charlotte Islands, comprising some 1,300,000 acres of land, much of which is heavily timbered, will in the future become a great agricultural country. These islands, lying some 80 miles west of Prince Rupert, enjoy a very mild climate owing to the proximity of the Japanese current. Oats, wheat and barley have been ripened in small experimental patches on the Nadu River. Potatoes, cabbages and all kinds of roots have been grown successfully at various points on Massett Inlet.



Looking West, Prince Rupert Harbour.



Canadian Government Elevator at Prince Rupert.

MINING.

Prospecting has been greatly encouraged by the assistance rendered by the Department of Mines in property examinations, trails, cheaper power, etc., also by the fact that more capital is available for the development of meritorious prospects.

Development has been greater than ever before in all parts of the northern portion of the province, and particularly in the Stewart, Alice Arm and Kitsumkalum Lake sections.

Production in 1926 reached nearly \$11,000,000 in the three metals produced in this north country, viz.: gold, silver and copper. This makes a total production in the preceding five years of over \$50,000,000, and approximately \$100,000,000 in twelve years, prior to which the output of this part of the province was negligible.

LUMBERING AND LOGGING.

The future of Prince Rupert is closely linked with the inevitable growing demand of the world for timber. Northern British Columbia is one of the world's greatest areas of timber which, as yet, is practically untouched. This area of many thousands of square miles of virgin timber will play an important part in meeting the world's demand for aeroplane spruce, pulp, lumber, poles, piling, posts and mining timbers. The timber industries are ever moving northward, and Prince Rupert is already established as the natural outlet for the products of this great northern region.

The Canadian National Railway in entering Prince Rupert passes through a timbered area more than 500 miles in width within which distance are located numerous saw mills, while the coast line both to the north and to the south is broken by numerous long inlets and natural canals penetrating virgin forests. To these is added the Queen Charlotte Islands, home of the "big sitka spruce," with their vast timber wealth.

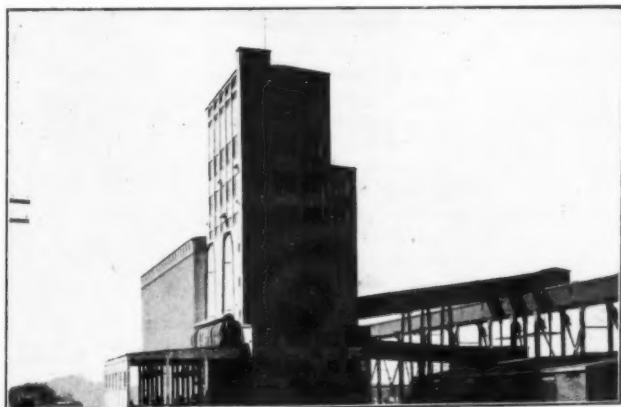
The saw mills adjacent to Prince Rupert and along the Canadian National Railways, on the western slope, have a daily capacity of more than a million feet of timber, in addition to which is a large production of cedar poles, piling and railway ties.

Raw material for the production of pulp and paper is almost unlimited, with water powers and transportation facilities for the successful development of such industries.

Close to Prince Rupert, the Skeena, the second largest river in British Columbia, enters the ocean. Its drainage includes the valleys of the Babine, the Kispiox, the Suskwa, the Bulkley, the Kitwancool, the Copper, the Kalum, the Lakelse, the Kayex and the Ecstall Rivers. These valleys are all densely timbered with virgin stands as yet only scratched on the edge of settlement. Many billion feet of spruce, cedar, hemlock, cottonwood, balsam and lodgepole pine adjacent to driveable rivers, await the coming of the pulp mill and the saw mill.

PULP POSSIBILITIES.

There are huge areas in the Prince Rupert forestry district and it is probable that in the near future there will be several pulp and paper mills established, one at least at or near Prince Rupert. The fact that there is good water power within reach and that there is both rail and water communication with good



Side Elevation of Elevator Building.

harbourage at a number of points in the neighbourhood makes this a desirable location for mills.

WATER POWERS.

The fact that cheap power is one of the most essential factors in the establishment of industry should favour Prince Rupert, where the district offers many first-rate sites capable of economical development of water powers.

There is, in rough figures, 350,000 horse-power awaiting the harness of industry, all of which is within a comparatively short distance of tide water or rail.

TRANSPORTATION.

Prince Rupert, being the nearest Pacific Coast port to the Orient, is the natural port of call for all steamers plying between the Orient and Canada. The Canadian National-Prince Rupert route saves 24 hours' steaming on the Pacific, and the railway grade between Prince Rupert and the East, being 4/10 of one per cent. as against 2 per cent. on other railways, surely places this port as the logical link between Canada and the Orient.

The valuable freights of silks, teas, etc., which carry high priced insurance, and which are now passing through southern ports, could be shipped through this port, thus effecting a great saving in time and money to their owners.

Prince Rupert has a daily train service to and from the east, the railway line following the banks of the Skeena River as far as Hazelton, 200 miles east, then switching over to the banks of the Bulkley River, which it follows for some distance. Beautiful scenery meets the eye all along the Skeena, with Indian villages and totem poles dotted along its banks.



The Storage capacity is 1,250,000 bushels.

The Canadian National steamships, *Prince Rupert* and *Prince George*, give a tri-weekly service between this port and Vancouver, and a weekly service to Skagway, Alaska. Besides this, there are three C.P.R. and two Union steamships calling each week.

The water trip from Vancouver is one of unsurpassed beauty, the entire distance being between islands timbered to the water's edge, and backed by snow-capped mountains, with here and there a cannery or logging camp in some sheltered bay.

The table of relative distances, taken from the Dominion Government Trade Map, gives a good idea of the favourable position held by Prince Rupert.

Table showing relative distances between the Port of Prince Rupert and Vancouver to the following Ports:—

	Prince Rupert.	Vancouver.
Brisbane	6,282	6,440
Bombay	9,080	9,540
Calcutta	8,280	8,740
Hong Kong	5,335	5,800
Honolulu	2,380	2,419
Manilla	5,535	6,000
Melbourne	7,195	7,360
Rangoon	7,720	8,180
Shanghai	4,795	5,180
Singapore	6,640	7,100
Sydney	6,651	6,840
Vladivostok	3,906	4,440
Yokohama	3,815	4,280

The Port of Montreal.

The History and Facilities of a Great Inland Harbour.

By LAURENCE CHALMERS TOMBS, M.A.

(Continued from page 142.)

FREIGHT RATES AND CHARGES.

FREIGHT rates and charges are distinctly favourable to Montreal. There have always been rate disputes between such ports as Boston, New York, Philadelphia and Baltimore, and latterly between southern and gulf ports like Savannah and New Orleans or Galveston, and also between the northern and southern groups. The rail distances from Chicago to the northern ports are as follows: Baltimore 796 miles, Philadelphia 817, Montreal 841 (a), New York 899 and Boston 979.

A brief history (b) of the freight rate differentials (c) may be interesting.

The Baltimore and Ohio Railroad first opened its line into Parkersburg, W. Va., in 1857. The rates between Baltimore and the southern part of what is now central territory were arbitrarily made by the B. & O. R. R., irrespective of the rates to and from Philadelphia and New York. The competition created by these lower rates was seriously objected to by the trunk lines serving New York and Philadelphia and also by the commercial interests of Philadelphia, New York, Boston, Cleveland, Toledo, Detroit and Chicago. The result was a demoralisation of rates, which from time to time was patched up by conferences between freight traffic officers of the eastern trunk lines and their western connections.

The first specific differential shown by the records was established in 1869, at which time the carriers agreed upon a grain differential of 10 cents per 100 lbs. in favour of Baltimore. In 1870, there was a rate war. In 1875, the west-bound class rates from Philadelphia were on a basis of 7-7-6-4 and 3 cents below New York on the first five classes, and from Baltimore 10-9-8-6 and 5 cents below New York.

On April 18th, 1876, a tariff was agreed upon based on distance. The rates were from Chicago to Baltimore 13 per cent. less than to New York; and from Chicago to Philadelphia 10 per cent. less than to New York. From south-western ports to Baltimore the rates were 14 per cent. less, and to Philadelphia 9 per cent. less than the New York rates. This agreement lasted six weeks, when a disastrous rate war ensued, which continued to July, 1877. Many of these rate wars were instigated by merchants in the rival ports. On April 5th, 1877, the New York Central, New Haven, Erie, Pennsylvania, and Baltimore and Ohio railways entered into an agreement under which there were established, in lieu of the percentage differences thereto existing, fixed differentials on east-bound and west-bound traffic as between New York, Philadelphia and Baltimore. The express purpose of the agreement was to avoid all future misunderstandings with respect to the advantages and disadvantages of the cities of Baltimore, Philadelphia and New York, as affected by rail and ocean transportation; and to establish an equalisation of the aggregate cost of rail and ocean transportation between all competitive points in the west, north-west, and south-west, and all domestic or foreign ports reached through the cities named.

The established differentials then fixed were: to Baltimore 3 cents below New York, and to Philadelphia 2 cents below New York, these being the differences in the ocean rates in favour of New York. On west-bound traffic from Philadelphia the differential became 6 cents on the first two classes, and 2 cents on the lower classes below New York, from Baltimore 8 cents on the first two classes, and 3 cents on the lower classes below New York; the rates to Boston were to be at no time less than to New York.

Notwithstanding the foregoing resolution, the rates were not uniformly maintained, and rate wars were in progress at various times necessitating frequent conferences between railway officials for several years. Nevertheless in the main the above differentials were understood to be the proper basis.

(a) New Orleans is 81 miles further from Chicago than is Montreal, but freight rates to New Orleans have become less than those to Montreal by 4 cents per 100 lbs., on packing house products, and 13 cents on agricultural implements, all rail, and 21 cents via rail and water, ostensibly to offset the longer steamship voyage and the slightly higher rates from New Orleans to Europe.

(b) From Appendix B, Interstate Commerce Commission No. 13548, Washington, February, 1925. Courtesy, Mr. E. N. Todd, Canadian Pacific Railway, Montreal.

(c) These rates apply on business from and to the Middle West; Montreal enjoys a preference over the port of New York by taking the Philadelphia rate basis on exports and the Baltimore or lower basis on imports.

Originally each of the trunk lines reached only one port. The Baltimore and Ohio terminated at Baltimore. The Pennsylvania reached Philadelphia only. The Erie and the New York Central both ended at New York. If grain and flour could not be exported via Baltimore, the Baltimore and Ohio could not haul them. If these commodities could not be exported via Philadelphia, the Pennsylvania could not handle them. (d)

During November, 1887, the Grand Trunk Railway reduced its export rates on fifth and sixth classes by 4 cents and 3 cents respectively to Portland, and 3 cents and 2 cents to Boston under the rates so established. Reductions were also made by the Grand Trunk on dressed beef, Chicago to Boston and Portland, all of which were promptly met by carriers serving the other ports. The rate on dressed beef to Boston finally became 3 cents lower than the rate to New York. A similar situation existed in 1890, and the rates on dressed meats were reduced in turn by the Grand Trunk and roads serving the other North Atlantic ports until they finally became, from Chicago to New York 30 cents, to Philadelphia 28 cents, and to Baltimore 27 cents. In 1888, an attempt was made to secure the maintenance of uniform rates on traffic to points located in central territory. Rules were adopted to that end on January 10th, 1888, the object at all times having been to equalise the through rates from the shipping point to the foreign destination via all ports. On February 29th of the same year, it was resolved that "thereafter the rates on export traffic be the sum of the inland tariffs plus the ocean rates current from time to time, except that the inland rates to Boston on export traffic may be the same as to New York." When the steamship lines, which had been going through a somewhat similar experience, formed what is known as the North Atlantic Conference and charged the same rates to and from all North Atlantic ports, the system presently in force was arrived at wherein it is cheaper to ship via Norfolk, Baltimore, Philadelphia and Montreal, than via New York or Boston, which principle is again being attacked by Boston, and has been objected to by the southern ports. These port differentials have been uniformly maintained for many years, although there have been fluctuations and differences on commodities like iron, steel and grain.

The export rates on iron and steel from Buffalo to New York, Philadelphia and Baltimore are in general the same as the Pittsburgh-Philadelphia rates. On February 1st, 1899, the rates on grain and flour from the middle states to Boston and Portland were made the same as the New York rates, to Philadelphia and Montreal one cent less than New York, and to Baltimore, Norfolk and Newport News, 1.5 cents lower than to New York. This adjustment has continued in effect to date without modification other than the reduction in the New York differential on export flour to the basis of 2 cents over Baltimore and 1 cent over Philadelphia, effective June 22nd, 1905, and that both Baltimore and Philadelphia are allowed a differential of 3/10 cent on ex-lake grain. The New York basis of ex-lake grain rates applies to Norfolk. In December, 1905, the Philadelphia domestic basis of rates from the central territory was established to Montreal.

The "Central Territory" may be described as that section of the Middle West from the western shores of Lake Huron directly south to the Ohio River, extending west to the Rocky Mountains, and north to the Canadian boundary, viz.: the great interior valley of the Continent.

On June 15th, 1910, a revision of the rules was made between Central Freight Association lines to the following effect:

- "(a) That New York rates would apply to the following ports on traffic transportation therefrom to foreign countries: East Boston, Mass., Levis, Que., Point Levis, Que., Quebec, Que., St. John, N.B., West St. John, N.B.
- (b) That New York rates plus 1 per cent. per 100 lbs., would apply to Halifax (about a year ago Halifax was placed on the New York basis.)
- (c) That Philadelphia rates would apply to Montreal."

DIFFERENTIALS CONTROVERSY.

While the above résumé has referred particularly to export rates, the same thing was going on in connection with import rates. Not only were there disputes between ports, but between railways serving the same ports such as Boston.

(d) Clapp, Ewin J., The Port of Boston, New Haven, 1916, p. 86.

Eastern railways, which had no direct, friendly rail connections, made alliances with weaker and more circuitous lines, also with later lines, and established and have maintained these to this day as differential routes. so that a port like Boston has a standard import rate and a differential import rate. In 1908, Boston lines published the Philadelphia basis of commodity rates on traffic moving via the line at whose pier the steamship was discharged; when forwarded via other lines the domestic rates were applied. On October 28th, 1908, the Boston and Maine gave notice that it was establishing the Baltimore basis of class and commodity rates. These disturbances continued in 1909-10, and the entire question of the relation of rates on import traffic as between New York, Boston, Philadelphia, Baltimore and Portland was submitted to the Inter-state Commerce Commission. The decision of the Commission made the standard all-rail and the standard rail-and-lake rates from Boston the same as from New York, with standard differentials by standard lines, ranging from 6 cents to 2 cents from Philadelphia lower than New York, and from Baltimore 8 cents to 3 cents lower than New York, which arrangement is now in force. These differentials are not observed where through rates are made over rail and water combination, such as, for example, rail to Buffalo, thence water; a comparison of these, as well as the rates to a Canadian point like Toronto, are shown in the following table.

Examples of Import Freight Rates in cents per 100 lbs. on General Merchandise. CLASSES.

To	From		1	2	3	4	5	6
Toronto	Montreal	W	67	59	52	41½	34	36
"	"	S	79	69	60	47½	39½	33
"	St. John		103	89	69½	48½	41	34
"	Boston		103	89	69½	48½	41	34
"	New York	S	108	94½	72	50	43	36
"	"	D	103	91	69½	48½	41	35
"	Philadelphia		108	94½	72	50	43	36
"	Baltimore		108	94½	72	50	43	36
Detroit	Montreal	S	103	89	70½	48½	41	34
"	"	W	89½	80	62	42	36	29½
"	St. John	S	103	89	70½	49½	41	34
"	Boston	S	111	97	73½	51½	44	37
"	"	D	106	93	70½	48½	42	36
"	"	SX	103	91	69½	48½	41	35
"	New York	S	111	97	73½	51½	44	37
"	"	D	103	91	69½	48½	41	35
"	Philadelphia	S	105	91	71½	49½	42	35
"	"	SX	97	85	67½	46½	39	33
"	Baltimore	S	103	89	70½	48½	41	34
"	"	SX	95	83	66½	45½	38	32
Chicago	St. John	S	134	116½	91½	63	53½	44½
"	Montreal	S	134	116½	91½	63	52½	44½
"	"	SX	119½	107	80½	56½	47	39½
"	"	W	102	90	68½	47	40½	33½
"	Boston	S	142	124½	94½	66	56½	47½
"	"	D	137	120½	91½	63	54½	46½
"	"	SX	129	113½	85½	61	51½	43½
"	"	DX	124	109½	82½	58	49½	42½
"	New York	S	142	124½	94½	55	56½	47½
"	"	D	134	119½	89½	62	52½	44½
"	"	SX	129	113½	85½	61	51½	43½
"	"	DX	124	109½	82½	58	49½	42½
"	Philadelphia	S	136	118½	92½	64	54½	45½
"	"	SX	123	107½	83½	59	49½	41½
"	Baltimore	S	134	116½	91½	63	53½	44½
"	"	SX	121	105½	82½	58	48½	40½

S—All rail Standard. D—All rail Differential. SX—Rail and lake Standard. DX—Rail and lake Differential. W—Via Canada S.S. Lines.

The basis of rail freight rates on imports to Canadian points favours the port of Montreal. From New York, Philadelphia and Baltimore, the domestic class, and with few exceptions, commodity rates apply on import traffic, while from Boston, Portland and Canadian ports special import tariffs are published. Rates from New York, Philadelphia and Baltimore, via standard lines, to eastern Canadian points, Kingston and west, are based upon the New York standard, except to territory between the Niagara and Detroit frontiers, to which points rates from Philadelphia and Baltimore are subject to differentials under the New York standard. Rates from New York via water and rail differential route enjoy the following arbitraries under the New York Standard basis:—

1	2	3	4	5	6	Classes
5	3½	2½	1½	2	1	1 Cents per 100 lbs.

Rates from Portland, St. John and Halifax are based upon the rates from Baltimore, New York, or Boston differential, whichever gives lowest, and subject to domestic rates as a maximum except that to main line points as far as Windsor, rates shall not exceed the Baltimore-Detroit rates. Rates from Boston via differential routes are maintained on the St. John basis and via standard lines are the New York standard rates except to points in Canada on the Michigan Central R.R., Toronto, Hamilton and Buffalo R.R., Pèrè Marquette Ry., and Wabash Ry. Co., to which points the differential basis is applied via standard and differential routes.

From Montreal, merchandise class rates are based upon the following differentials under those from St. John, with local rates as a maximum:

1	2	3	4	5	6	Classes
2	2	2	1	1	1	1 Cents per 100 lbs.

Commodity rates from Montreal are 1 cent under those from St. John.

This history of these differentials has been recited to show how the present rate bases were arrived at, and also that the original disputes were between American interests rather than between Canadian and American ports, although the Canadian railways were frequently involved. The tables of comparative rates emphasise the favourable position of Montreal as compared with all other ports especially on import business. Even more favourable rates are available on bulk cargoes in the west-bound empty grain lake vessels.

PORT OF NEW YORK.

In the report of the Inter-state Commerce Commission on the complaint of the Maritime Association of Boston Chamber of Commerce, I.C.C. No. 13548, February, 1925, the following advantages of New York were demonstrated as compared with southern ports, also reasons why so much traffic has been attracted to New York notwithstanding its frequent congestion, rising costs, and the fact that rail export and import freight rates to and from New York are higher than those to and from Philadelphia, Baltimore, Norfolk and Montreal, and the same as to and from Boston. They also serve to show why the South Atlantic and Gulf port have hitherto secured comparatively little export traffic from the Middle West, in spite of reductions in inland freight rates.

"The influence of bulk cargo in volume; frequency and regularity of steamship sailings; superior and faster steamship service; wide range of foreign ports reached by regular steamship service; superior banking facilities; shorter ocean distances to Europe; location at New York of headquarters for the leading steamship lines, and also for export and import commission and commercial representatives of foreign countries and foreign buyers; volume of export tonnage produced locally in the New York district; volume of exports moving locally to New York for storage, handling, and sale through local export commission houses; volume of imports consumed locally in the New York district; advantageous marine insurance rates and facilities; availability of ocean space on 'distress' room; ability of the trunk lines to secure export freight for their long haul from differential territory; use of long established trade routes and port arrangements; free lighterage service permitting change of local destination at will; and, as the domestic and export rates to New York are with few exceptions equal, forwarding shipments to New York on either domestic or export bills of lading; and finally New York's strategical position as the terminus of several trunk lines from the West."

PORT CHARGES.

The harbour charges at Montreal are exceedingly reasonable, in fact lower than at many other ports. This is all the more remarkable considering that the port is only open during seven months of the year. The railways using Montreal are free from the increasing cost of lighterage such as is necessary in New York. The Harbour Commission switch cars promptly to and from the piers at a flat rate of \$3.50 per car, which is cheaper than the railways can do it. The steamships pay no tonnage dues other than the nominal Port Warden's fee, ranging from ¼ cent per barrel on apples to 2 cents per ton on general cargo. No charge is collected on wheat (e), flour, hay, cattle and ores. Small charges are made for surveys and certificates (f), sick mariners' dues, etc. The cargo pays the necessary charges rather than the carrier. Top wharfage is assessed on all goods handled through the port. On imports, this wharfage is paid on goods destined beyond, by the inland carrier who debits the steamship with half of it. On local shipments to or from Montreal, the wharfage is paid by the shipper or consignee. On exports, other than grain, the wharfage is nearly always included in the inland rate and therefore, absorbed by the inland carriers who endeavour to take account of it in establishing their rates. Examples of the wharfage rates are as follows:—Apples, 20c. (per ton of 2,000 lbs.), automobiles 40c., iron or steel billets 24c., fire brick 15c., cement 10c., anthracite coal 9c., bituminous 7c., dry goods 45c., flour 11c., grain 6c., jute 20c., lumber 12c. per 1,000 ft. B.M., petroleum in bulk 10c. (per ton), newsprint paper 20c., sugar 20c. (g). The charges for the elevation of grain are covered in Chapter IV.

Steamship lines maintaining a regular service are allotted permanent berths which must be applied for early each year. These berths cost from \$6,500 to \$12,000 per year. The regular liners handle the cargo to and from ship's side at their own expense, and the inland carriers assume the expense of transferring to and from alongside the ship and their cars or lake craft. The basic rate for longshoremen is 62c. per hour per eight-hour day, 72c. for night work, and double time on holidays. The rate at New York is 80c. per hour per day and \$1.20 for night work.

(e) The steamer pays the cost of elevator delivery, i.e., four-tenths of one cent per bushel.
(f) Revised rules and by-laws of the Office of Port Warden, Harbour of Montreal, 1923.
(g) By-law 92, Harbour Commissioners of Montreal, June 25th, 1925.

Voyage account of "ss. Rio Dorado" from Hull to Montreal in ballast, and from Montreal to Hamburg with grain, May 20th, 1925, illustrating Port Charges. (h)

Received for disbursements from Simpson, Spence and Young, exchange on American cheque at 1-16 per cent.	4.25	6,800.00
Attendance fee	150.00	
Bags and separation cloths	1,035.25	
Bill of health	1.00	
Boatman at Quebec	5.00	
Board of Trade shipping fees	1.80	
Bunker Coal	—	
Cash to Captain	270.00	
Charts	—	
Consul fees	11.00	
Elevating grain—	\$	
100,000 bushels Rye	400.00	
356,554 bushels Oats	1,426.20	
Overtime	40.00	1,866.20
Doctor	—	
Harbour Commissioners water	—	
Immigration	—	
Laundry	7.05	
Pilotage—sea to Quebec	54.18	
Pilotage—Quebec to Montreal	58.00	
Pilotage—Montreal to Quebec	106.33	
Pilotage—Quebec to sea	88.97	
Pilotage—Apprentice inward	10.00	
Pilotage—Apprentice outward	15.00	
Pilotage—Harbour	10.00	
Port Warden	8.00	
Postage, petties, war tax stamps, etc.	5.00	
Repairs	65.85	
Shipping Federation	—	
Ship chandler	224.91	
Sick mariners' dues	55.32	
Stevedoring	1,087.42	
Fittings	1,348.08	
Telegrams and cables	17.49	
Towage 40-80-40	160.00	
Wharfage on ship's stores	1.00	
Watchman	30.00	
Balance in favour of steamer	102.90	
	\$6,800.00	\$6,800.00

Revenue Figures of the Port of Montreal for certain years between 1882 and 1925. (i)

1882	249,130.91
1897	255,416.86
1902	327,236.07
1907	498,661.12
1912	1,049,311.50
1917	1,850,464.93
1922	3,460,810.87
1925	4,749,100.69

Hon. Calvin Tomkins, President of the American Association of Port Authorities, Ex-Commissioner of Docks and Ferries, New York, in 1924, stated: "The Port of Montreal affords the best example of modern seaport organisation, possessing unity of control, opportunity for expansion on a carefully prepared plan, which permits of such expansion for generations to come; adequate articulation of land and water factors and co-ordination of their uses under intelligent supervision, which have the effect of bringing into operation all of the separate factors, which combined, best serve the terminal needs of a seaport community. (j)

THE NORTH ATLANTIC STEAMSHIP CONFERENCE.

Montreal enjoys the same ocean rates generally as the north Atlantic ports to and from Europe. (k)

In the early sailing ship days there was little variety in the methods by which goods were shipped overseas. A ship, whether it were chartered to take cargo in bulk or merchandise for a large number of shippers, would receive its cargo at one port and not sail until its cargo space were more or less full. The length of time a steamer would take between two points could be estimated with precision, only after the substitution of steam for sail. The steam tonnage of the United Kingdom alone rose from 454,327 tons in 1860 to 1,112,934 tons in 1870 and 2,723,468 tons in 1880. The requirements of the trade were over-supplied, severe competition among shipowners resulted and rates fell heavily. In fact the struggle became so keen that many of the lines had to withdraw and the remainder began to draw together so as to avoid bankruptcy and disaster by coming to a mutual agreement with shippers. The problem of that time is not dissimilar to that which confronts shipowners to day. On the one hand, they have to place themselves in a position to obtain rates which will be remunerative; on the other hand, they have to conform to the requirements of trade by giving regular sailings of high class vessels despatched on advertised sailing dates. The competition which existed in those days was not simply between liners on the one hand and tramps on the other, but also between the different lines of steamers, which were described as being engaged in a "hand-to-hand" competition with an over-supply of tonnage and impoverished rates of freight.

In the North Atlantic trade sailings are regular, the ships are of the highest class, and the rates uniform and fairly stable. The dominant importance of this trade is the passenger traffic. Not only do the requirements of this traffic render it necessary to supply vessels of the highest class and greatest regularity, but the number and tonnage of such vessels are so great that the room available for cargo is frequently out of all proportion to the freight coming forward.

The North Atlantic Steamship Conference, according to its members, is not in any sense a combine, but the interests of the large number of individual companies operating steamers from North Atlantic ports required some form of joint action in respect to rates. The United Kingdom Conference does not direct or in any way interfere with the making of eastbound rates by the North Atlantic Freight Conference, the rates being made equitably to permit steamers to pay expenses and the manufacturer to export. Furthermore, in the list of eastbound rates promulgated by the North Atlantic Conference, no rate or agreement is made in respect to grain, flour, or cattle, these rates being absolutely open.

ADVANTAGES OF THE SYSTEM.

The advantages which accrue to Canadian exporters through the operation of the Conference system may be summarised as follows:—

- 1.—Improvement in service. Regularity of service resulting in the following advantages:—
 - (a) Opportunities to merchants for shipping are increased, resulting in much greater increase in volume of trade.
 - (b) Fixed dates of sailing at regular intervals enabling shippers to work with smaller stocks than they otherwise could, thus reducing risks as well as storage and interest charges.
 - (c) Make unnecessary the engaging of cargo space considerably in advance.
 - (d) Merchants are enabled to make forward contracts for delivery of goods at a definite date.
 - (e) Without regularity of service in long distance voyages, or in the new and undeveloped services, Canadian merchants would be operating at a great disadvantage as compared with European merchants, who now have the benefits of a more highly developed service from European ports to foreign ports.
- 2.—Greater security given to capital invested in the steamship business. Because of this greater security, shipowners are enabled to supply an adequate number of vessels of a higher class, of greater speed and provided with every modern facility for the development of the trade. To many merchants, the adaptability of the service to the requirements of trade is highly essential because of the nature of their exports and imports. The following advantages are to be gained under this heading:—
 - (a) Cargo is delivered in better order and with greater despatch and regularity.
 - (b) Insurance premiums are reduced owing to the better class of vessels being employed.
 - (c) Loss of interest on the cargo while in transit is reduced.
 - (d) Shippers are relieved of anxiety as to the class of vessel by which their freight will be shipped.

- 3.—Stability of rates over long periods of time:—
 - (a) Removes the inconvenience which would exist if merchants and shippers were obliged to make different quotations on nearly every consignment. A uniform selling price in foreign markets is considered highly essential by merchants. Moreover, lines seek to give reasonable notice of alteration in rates.
 - (b) Reduces complaints from buyers abroad. During periods of competition, complaints come from foreign buyers if sales to them do not happen to be on the lowest basis of cost and freight.
 - (c) Enables shippers and merchants to calculate laid-down cost and to sell goods for future delivery.
 - (d) During periods of rate cutting, buyers abroad buy from hand to mouth because they never know what the goods will cost them by the time they are received.
 - (e) It is to the interest of the lines not to charge rates detrimental to the development of traffic. Shipowners depend for success on the goodwill of shippers, and to build up business they must establish rates which will enable their clients successfully to compete with foreign merchants in the same trade.
 - (f) If the rates charged by the regular lines should exceed or even approximate the chartered rate for tramp steamer, shippers can protect themselves by the employment of tramps for the transportation of their shipments.

- 4.—Uniform freight rates secured to all merchants. Uniform rates protect the small as against the large shipper. A merchant shipping one ton of butter or any other commodity would receive the same rate as the Corporation shipping 100 tons.

- 5.—Cost of service can be more economically distributed over traffic so as to develop trade. By reducing rates on articles where the rate would bear too heavily, and securing compensation on other items where the value and size justify the same.

(h) Exhibit No. 91, pages 984-5, Proceedings of the Committee, Ottawa, May, 1925.

(i) Figures supplied by Harbour Commission, Montreal, April, 1926.

(j) Proceedings of the American Society of Port Authorities.

(k) The ocean rates on grain and flour are usually lower from New York than Montreal.

COMPARISON BETWEEN A "LINER" AND A "TRAMP."

It may also be of advantage here to sketch briefly the conditions under which the business of a liner is worked as compared with that of a tramp steamer. The liner maintains a regular service in a given trade, year in and year out. It is customary for advertised sailing lists to be published for a considerable period in advance so that all shippers can depend upon definite opportunities for shipment of their goods; the risk of securing cargo for these sailings is borne entirely by the liner shipowner, and it is no exaggeration to say that the liner shipowner runs the risk of sending his ship away at times very short of cargo through conditions making it impossible to obtain a full cargo. The failure of a liner shipowner to sail his vessel on the date advertised or to perform the voyage within a given time would entail not only loss in interest, but occasionally loss of market, and the liner shipowner who fails to keep faith with all the obligations he professes would soon find himself deserted by the majority of shippers whose favour he solicits.

The tramp shipowner, on the other hand, conducts his business in an entirely different manner. He does not confine his operations to any one particular trade; he is prepared to send his ship anywhere, but does not send her on a voyage without a definite contract of affreightment, at least, in one direction. If his vessel fails to receive a complete and full cargo, he either receives an equivalent in an increased rate of freight or some other consideration to compensate him for sending his steamer on a given voyage without a full load. The shipper must also load his cargo within a given time. No tramp shipowner would undertake to send his steamer to sea on a given day whether the cargo be ready by the specified time or not, and if the ship is delayed he receives compensation from the shipper in the shape of demurrage. (l).

As already indicated, the eastbound ocean rates on general cargo, except grain, flour, and cattle, to the United Kingdom are the same from Montreal, Quebec, St. John, Halifax, Portland, Boston, Providence, New London, New York, Philadelphia, Baltimore, Norfolk, and Newport News. Until very recently there were three distinct rate schedules to the United Kingdom and Europe:—(1) rates from the North Atlantic ports included in the above group; (2) rates from South Atlantic ports such as Charleston and Savannah were $7\frac{1}{2}$ cents higher than the North Atlantic group; (3) rates from the Gulf ports such as New Orleans and Galveston were 15 cents higher than the North Atlantic group, with even greater spreads on such local southern products as cotton, lumber and turpentine. These remained in force until January 20th, 1925, when the United States Shipping Board, as a result of strong complaints from the southern ports and shippers, decided to cancel the arrangements. Therefore, there is now no agreement on rates between the different groups, although undoubtedly the intention is that through rates from actual shipping point to destination are to be equalised. (m).

The rates on grain from New York by liners are usually about 6d. per quarter (480 lbs.) less than the rates from Montreal.

The North Atlantic Steamship Conference holds regular meetings in New York, and meets from time to time in Montreal. (n). Rates generally are discussed and arranged by them, Canadian lines being given the initiative on such purely Canadian exports as asbestos, nickel, woodpulp and deals. There is a Conference or a sub-division of the Conference for each particular trade, such as Trans-Atlantic—Continental Conference, Trans-Atlantic—French, Scandinavian and Baltic, West Coast Italy, Far East, etc. Rates to South Africa, Australia, and New Zealand are on a parity from North Atlantic ports; but to South America, although originally on the same basis as New York, they are now occasionally a little higher from Montreal. The rates from Montreal to the West Indies are the same as from New York. Coastwise rates from Montreal to Vancouver are generally the same as from New York. The same rates apply westbound from United Kingdom as from the Continent (o), all the North Atlantic ports enjoying the same ocean rates on imports.

U.S. SOUTHERN PORTS.

The United States southern ports are now doing a large business, especially with South America and the West Indies,

(l) Extracts from Reply of Steamship Lines engaged in the Canadian North Atlantic Trade to the Report made by Mr. W. T. R. Preston to the Minister of Trade and Commerce on Ocean Freight and Passenger Rates from Canada, 1925.

(m) The effect has been to provide considerably lower through rates from Chicago and a portion of the Middle West to Europe and other markets by way of the southern and gulf ports than via the northern ports. Do the Canadian railway, ocean port and commercial authorities generally realise that the St. Lawrence route no longer enjoys the full advantage of its geographical position?

(n) Canadian Conference has been constituted composed of the steamship lines operating between the St. Lawrence and Europe. This meets regularly in Montreal and deals with commodities in which the United States lines are not interested.

(o) Eastbound ocean rates are frequently lower to the Continent than to the United Kingdom.

but the preference arrangements known as the Canada-West Indies Trade Agreement, it is hoped, will further develop and increase the very satisfactory trade now being exchanged between the latter. It is expected that increased commerce will result from the Canada-Australia Trade Agreement, which has already necessitated the putting on of extra steamers.

The usual freight brokerage or commission of $1\frac{1}{4}$ per cent. of the ocean charges is paid by the Canadian steamship lines to freight forwarding agents on exports, except when destined to the United Kingdom and the Continent.

This practice applies to the ports of Montreal, Quebec, St. John, Halifax, Portland and Vancouver. At Boston, New York and United States ports generally, the Commission is available on all business.

(To be continued).

Improvements at Hull.

New Oil and Railway Jetties.

The London and North-Eastern Railway have built a second oil jetty with pipelines at Saltend, near Hull, and the berth for tank steamers will be available very shortly. This is a duplicate of the existing accommodation which has served the port for several years, and has been rendered necessary to keep pace with the fresh expansion of the import oil trade. The jetty is constructed of timber and is 1,900 ft. long, and is situated 1,000 ft. to the westward of the jetty now in use.

At this part of the River Humber the channel is fairly constant, but extensive mud flats reach from the river bank to the deep water. Berthage is provided at a T-head, 330 ft. long and parallel to the channel. This consists of a well-braced timber-piled structure, to which a large dredged embayment gives deep-water access from the channel. The pipelines provided in connection with the new jetty will be on a "common user" principle, connecting up with the individual petroleum companies pipelines at the shore end.

On the Lincolnshire bank of the river a new railway jetty, which has been under construction for five and a half years, was brought into full use at the beginning of April. Railway trains are now able to run from the mainland station at New Holland to the pierhead, where the passengers are transferred to the paddle steamers owned by the London and North-Eastern Railway Co., for conveyance across the river to the Corporation's pier at Hull. The next work to be taken in hand will be the improvement of the landing facilities at Hull, which are at present entirely inadequate. A joint scheme, in which the Railway Company and the Hull Corporation would share the cost, has been under discussion, but appears to be in abeyance for the time being.

At the last meeting of the Humber Conservancy Board, the engineer (Mr. A. E. Butterfield) reported that the River Humber above Hull had remained fairly stable during the past year. The depth was particularly good, and the width of the navigable channel only very slightly below the average. The river below Hull was exceptionally good, both the three and five-fathom channels being better than the average and the governing depth equal to the best yet experienced.

Port Dues in Yugoslavia.

Prevailing Rates of Exchange.

The Department of Overseas Trade has received from the Commercial Secretary at Belgrade the following official rates of exchange for the payment of port dues in Yugoslavia during the month of April, which appeared in the "Official Gazette" of 29th March:—

	Dinars.
1 Gold napoleon	218.90
1 Pound sterling	277.45
1 American dollar	56.85
1 Canadian dollar	56.55
1 German mark, gold	13.60
1 Polish zloty	6.38
1 Belga	7.92
100 French francs	223.70
100 Swiss francs	1094.70
100 Italian lira	900.50
100 Dutch florins	2289.00
100 Roumanian leis	35.00
100 Danish crowns	1524.00
100 Swedish crowns	1526.00
100 Norwegian crowns	1518.00
100 Spanish pesetas	956.00
100 Greek drachmas	75.30

Personal enquiries regarding shipping and transport matters should be made at the City Office of the Department (Shipping and Transport Section), 78, Basinghall Street, London, E.C.2.

Harbour Electrification.

Notes on Some Applications of Electricity and Electric Control Gear to Harbour Works.

INTRODUCTION.

There exists a very large field in modern harbour works for the successful application of electric power plant and automatic control gear, and it is the purpose of this article to outline a few typical cases where electricity has been very successfully used.



Fig. 1. Pneumatic Elevator, Meadowside Granary, Clyde Navigation Trust.

One of the largest harbour trusts in Scotland, for instance, makes an extensive use of electricity and automatic control gear. Fig. 1, for instance, shows a pneumatic grain elevator belonging to the Clyde Navigation Trust in which the plant is controlled automatically.

Fig. 2 shows the air compressors at one of the docks, driven by a 290 h.p. motor, supplying air to three docks. The motor shown is controlled by a self-acting starter by the Igranic Electric Co. Two phases of the starter circuit are closed and opened by a double pole clapper switch, fitted with a powerful magnetic blow-out. An appropriate number of double pole clapper switches are connected in the motor circuit, and arranged to short circuit automatically successive sections of resistance in each phase. Rotor currents are balanced on all steps. The interval between the closing of the successive secondary switches and, in consequence, the rate of acceleration of the motor, is governed by an adjustable timing relay. No-voltage release is an inherent feature of the design, and an overload relay may be added. This relay is connected in two phases, and is of the inverse time limit pattern. Its contacts do not open on a momentary overload, or with a high starting inrush, but operate to disconnect the motor should an excessive overload be maintained.

HYDRAULIC PUMPS.

At the same docks hydraulic pumps driven by 50 h.p. motors are controlled by fully automatic starters, comprising a main contactor equipped with a magnetic blow-out and a number of accelerating clapper switches, which are controlled by a series of relays and serve to cut out successive steps of resistance. All the switches are provided with inter-locking contacts to ensure proper sequence of their operation.

A master switch is used to close the main contactor, which in conjunction with the individual series of relays controls the accelerating switches. The winding of each relay is cut in to the main circuit in turn, and through the action of the relay the closing of the accelerating clapper is governed by the motor current. Thus the controllers allow of acceleration in the shortest possible time consistent with the maximum current sizes, and in accordance with the actual load on the motors.

The same docks include thirty Igranic water-tight capstan controllers, four circular lifting magnets and a large number of contactor type crane controllers, for motors as large as 200 h.p. for coal handling and ore unloading.

PNEUMATIC ELEVATORS.

A number of pneumatic elevators and lifts installed in a large granary on the Clyde are all motor driven and controlled by automatic control gear. In one case a lift operating on 13 floors, and the control gear for this lift consists of a unit comprising two double-pole main reversing contactor switches with a mechanical interlock to prevent the possibility of both closing at one time; a multiple-finger type accelerating unit, equipped

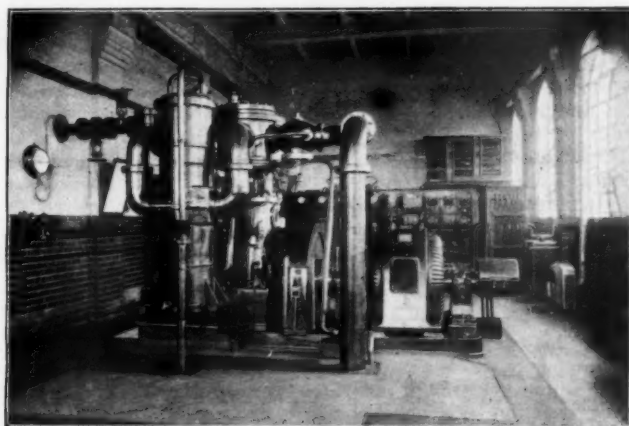


Fig. 2. Air Compressor at Prince's Dock, Glasgow, driven by 290 h.p. Motor controlled by an Open-type Panel. The Plant supplies Air to Clyde Trust Graving Docks 1, 2 and 3.

with an adjustable timing oil dash-pot; two fuses in the control circuits; and a triple-pole relay for the motor field and brake solenoid circuits. The motor circuit is always closed and opened by the reversing contactors which are fitted with renewable circuit-breaking contacts, and a magnetic blow-out. Thus, all other parts (including the accessory switches) are relieved from injurious sparking and arcing. It is impossible to close the motor circuit unless all starting resistance is included. Also the attendant cannot leave the apparatus in an intermediate position between "full on" and "off."

A BELFAST SCHEME.

One of the most complete electrification schemes carried out is that at the Belfast Yards of Messrs. Harland & Wolff, where, in addition to numerous machine tool drives, electric power is used for driving the hydraulic and compressed air machinery. The contracts for several important sections were entrusted to the General Electric Co.

The most interesting of these included the motors with Ward Leonard control equipment shown in Fig 3, for operating the pumps which supply the hydraulic power used in the yards. The method employed for automatic regulation of the hydraulic pressure is particularly worthy of notice.

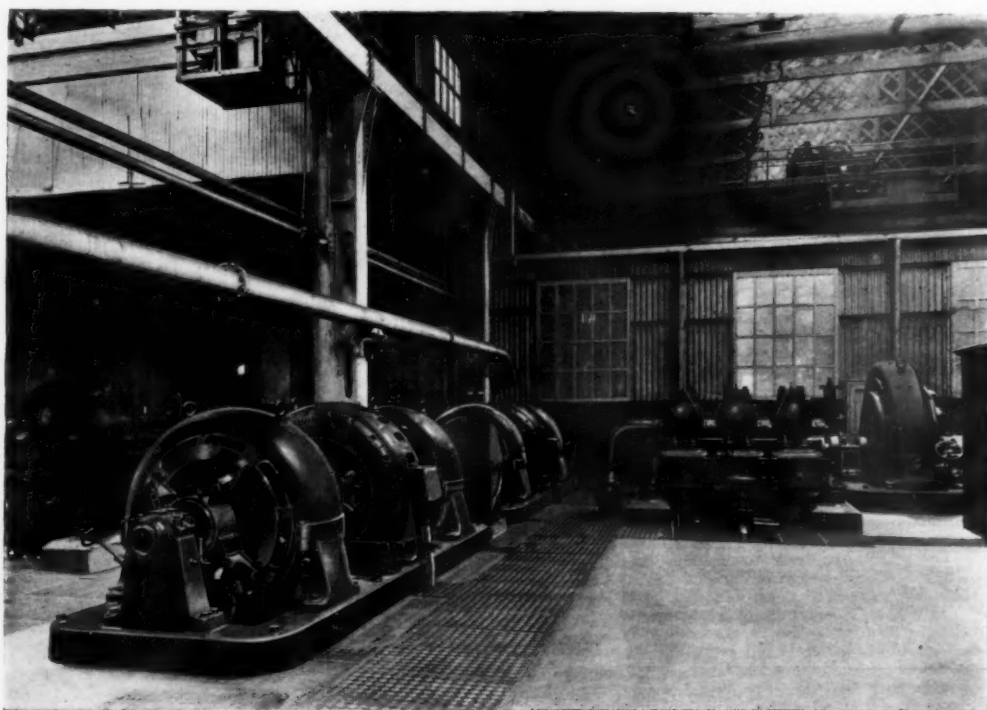


Fig. 3. Motors with Control Equipment for Pumps which supply Hydraulic Power at the Belfast Yards of Messrs. Harland & Wolff.

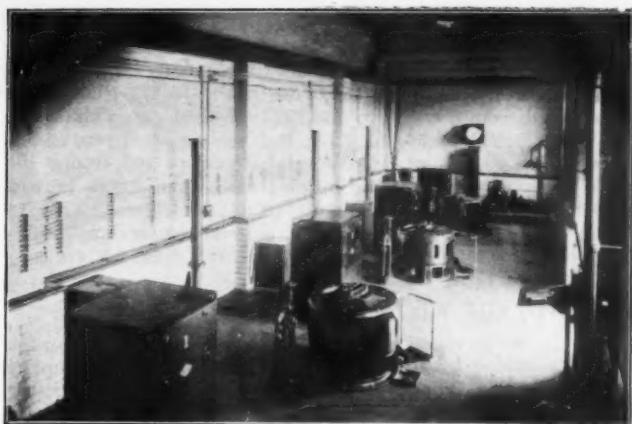


Fig. 4. Four Panels controlling four 150 h.p. Vertical Spindle Pumps, Clyde Trust Graving Dock, Glasgow.

It is obviously essential that the hydraulic pressure should be maintained constant under variations of load, and this is ensured by an arrangement which enables the floating ram of the accumulator to operate the resistance in the field circuit of the Ward Leonard generator.

The hydraulic pumping sets, which are shown in Fig. 4, consist of two 200 h.p. d.c. Witton motors, 440 volts, 0/60 t.p.m., direct coupled to reciprocating pumps supplying accumulators.

MOTOR CONTROL.

The motors are operated on the Ward Leonard system, and are automatically controlled from the hydraulic accumulators in the following manner: Each pump motor is separately excited, and speed regulation is obtained by varying the voltage on the d.c. generator of the Ward Leonard set by means of a shunt field regulator. This shunt regulator is operated automatically from the hydraulic accumulator by an arrangement of chains and sprocket wheels, illustrated in Fig. 5, so that the amount of resistance in the field circuit depends upon the position of the ram.

The rate at which the resistance is either increased or decreased is governed by a special spiral pulley, which is arranged to increase the rate of cutting out resistance when the hydraulic ram falls, and as the latter rises the resistance is cut out more slowly. It follows, therefore, that when the ram is in a low position the speed of the motor is high, and vice versa. At a final pre-determined height of the ram the generator field circuit is broken and the motor stops. An adjustment is fitted which enables the motor to be stopped when the ram is at certain other heights, if required. The field regulator can be hand operated, if desired. The above system of automatic control prevents any possibility of the motor standing still with current passing through it.

The two Ward Leonard sets for supplying the pump motors each consist of one 550 h.p. 3-phase slip-ring Witton induction motor, 440 volts., 50 cycles, 550 r.p.m., direct coupled to two 165 k.w. 440 volt. d.c. generators. Although either of these generators is of sufficient capacity to drive one motor pump, two motor generator sets have been installed to provide for future developments.

The motor of the Ward Leonard set is started by means of a drum type controller, fitted with a special operating handle and separate heavy duty resistance. The handle performs the operation of cutting out the resistance in the rotor circuit, and when the motor is running at its normal speed it also operates the slip ring short circuiting gear. This is effected by means of a simple device consisting of a specially-designed rocker, which is connected to the controller handle by a wire

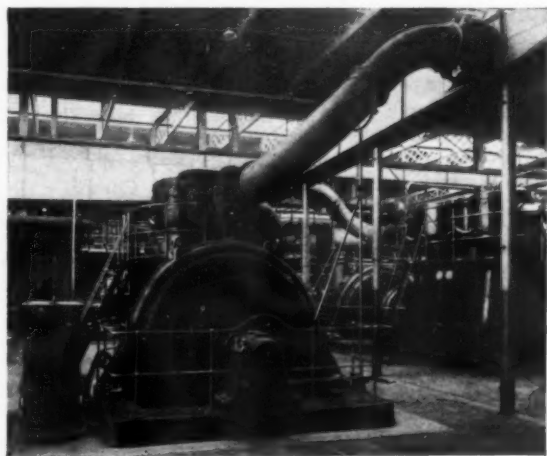


Fig. 6. Two of three 750 h.p. 3-phase Witton Induction Motors, driving Belliss & Morcom Air Compressors.

rope operating around pulleys. The starting movement of the controller handle does not affect the rocker, but when all resistance is cut out the arm lifts the rocker and short circuits the slip rings.

In case of emergency the pump motors can be supplied direct with power from the 440 volt. busbars in the sub-station. Separate field regulators are supplied for each pump motor, and are so arranged that they may be connected in circuit with either of the generators.

Another important section of the electrical plant is that in the compressor house, shown in Fig. 6, which illustrates two of three 750 h.p. 3-phase Witton induction motors driving Belliss & Morcom air compressors. Each of these motors is controlled by a G.E.C. liquid starter, which has been specially designed for starting large A.C. motors up to 1,700 h.p. This liquid starter consists of a welded steel tank, three earthenware chambers and top and bottom electrodes, with the necessary operating gear and accessories.

PUMP AT CARDIFF DOCK.

An interesting installation of electrically driven pumps is that at the Cardiff Docks of the Great Western Railway. This installation comprises four multi-stage high-pressure turbine pumps, serving two accumulators for the purpose of providing hydraulic power for the docks. There are also two low-pressure centrifugal pumps, each of 195 h.p., controlled automatically by means of float gear, which maintains a constant level of water in an open tank from which the high pressure pumps draw their supply.

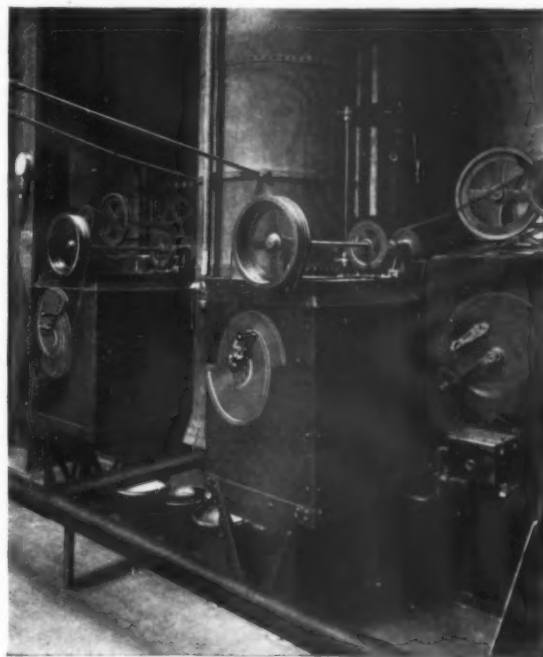


Fig. 5. Arrangement of Chains and Sprocket Wheels which automatically operate Shunt Regulator from the Hydraulic Accumulator.

Each of the high-pressure pumps is driven by a 650 h.p., 6,600 volt. slip ring induction motor, and is capable of delivering 800 gallons of water per minute against a pressure of 800 lb. per square inch.

The control is entirely automatic, the motors starting and stopping according to the demand for water. The scheme of control is specially designed to afford maximum protection to the high-tension motors and pumping plant, which may be called upon to start and stop as often as 40 times per hour.

Contact-type controllers are used throughout, the high tension contactors for the starters being of the air break type. Provision is made for distributing the work equally between the four motors and pumps, and for starting or stopping any set by hand independently of the position of the hydraulic accumulators. Any set can be shut down without interfering with the sequence of operation of the others. Safety devices are provided so as automatically to shut down the high pressure pumps in the event of a burst main or should the water in the suction tank fall below a certain level. Various safety features render the operation of the pumps absolutely fool-proof.

When the motor is stationary the starter circuit is open and isolated from the line. When starting, the starter circuit is first closed through a charging resistance designed to limit the switch-on voltage to about 3,000 volts. This charging resistance is then short-circuited after a definite time interval, and full line voltage thus applied to the starter. Acceleration is completed by cutting the rotor resistance out step by step by means of the rotor contactors until full speed is attained, when the slip-rings are short circuited. The control system, which was designed by Electric Control, Ltd., is entirely auto-

matic and interlocked, so as to ensure correct sequence of operations throughout.

SOUTHAMPTON INSTALLATION.

Another interesting installation is that at the Southampton Docks, the chief feature of which are the automatic controllers for the de-watering pumps, of which there are two of 950 h.p. and two of 1,200 h.p. There is a large number of smaller units consisting of impounding, drainage, pruning and house pumps, the installation being for six docks and totalling in all over 5,500 h.p. All the pumps are of the centrifugal, electrically-driven, some being supplied from an a.c. system of 6,600 volts., 3-phase, 50 cycles, and the others from 400 volts. d.c.

Contact controller are used throughout, except for the priming and house pumps, and are operated by push buttons. The control gear is complete with instruments and all necessary protective and isolating features, each controller being self-contained and fool-proof.

One 1,200 h.p. two 950 h.p., and one 350 h.p. de-watering pumps are driven by 6,600 volt. asynchronous-synchronous motors. The scheme of control is specially designed to protect the motor and plant, the arrangement being similar to that installed at Cardiff Docks.

In addition to the accelerating contactors, the equipment includes the necessary synchronising contactor, relays and instruments, and the regulator for the exciter. The control is entirely automatic, and arranged to change over automatically to the synchronous running position, when the correct conditions are established.

The 1,200 h.p. d.c. motor is controlled by a push button operated contactor controller. A hand-operated shunt regulator is installed for adjusting the final speed of the motor.

Contact controller operated by push buttons were required for these large motors in order to simplify the process of starting and stopping and to ensure reliability. The system of interlocking employed renders the various controllers fool-proof, the motors consequently always starting correctly and without undue electrical or mechanical stresses. This control gear was also designed by Electric Control, Ltd.

Port of Southampton Topics.

PASSENGER TRAFFIC.

The official returns of the Board of Trade now available show that Southampton easily retained its title of Premier Passenger Port in the United Kingdom last year. Of the 673,880 passengers outward and inward in 1927, Southampton dealt with 33 per cent., Liverpool 28 per cent. and London 19½ per cent. In 1927 Southampton's first class passengers inward jumped by nearly 2,500, and the total was almost twice that of Liverpool. The second-class total, however, fell by over 3,000, where that of Liverpool increased. In third-class traffic inward Southampton recorded an increase, but it was by no means so marked as that of Liverpool. Southampton's total inward was 77,819, against 76,890 in 1926, while Liverpool was 65,071 as compared with 60,226 in 1926. In the matter of outward figures Southampton holds an all-round advantage. The first-class passengers who were outward from the port numbered 35,752 as compared with Liverpool's 25,640, and the second and third-class figures respectively were 37,704 against 29,108 and 71,543 against 69,058. Southampton's total number of passengers was, therefore, 144,999 and Liverpool's 123,801. Both these totals represent increases over the figures for 1926, which were:—Southampton 141,635 and Liverpool 116,672.

A BUSY EASTER.

The extent of the cross-Channel traffic from Southampton during Easter was a record. The Southern Railway staff were kept working at high pressure during the week for the bookings called for additional sailings in some cases. The services from Southampton to Havre, St. Malo and the Channel Islands are, of course, but one section of the Company's cross-Channel activities, and if the services at the other ports had as successful a time the authorities had every reason to be pleased. Not only was the total of cross-Channel passengers from the port a record, but each of the routes separately returned record figures. During Easter week nearly 3,000 passengers used the services. So great was the pressure that it was necessary to run two vessels to the Channel Islands on two days. The totals on the three routes were as follows:—Havre, 1,458 against 1,121 last year; the Channel Islands 1,431 against 1,242; and St. Malo 816 against 627 last year. These figures are regarded as an indication of Southampton growing in popularity as a centre for this traffic.

The traffic figures for the whole of March were also satisfactory. With the exception of three headings substantial increases over the figures for March, 1927, were recorded. There was a decrease in the number of vessels both outward and inward, the former falling from 272 to 249, and the latter from 276 to 256. Despite this there was an all-round increase in tonnage. The gross tonnage inward was 1,387,018, com-

pared with 1,171,844, showing a rise of 165,174 tons, whilst the outward figure was 1,301,264 against 1,212,073, a rise of 89,191 tons. The net tonnage totals were equally gratifying to port authorities, for inward they rose from 619,571 to 715,569, and outward from 630,000 to 704,911. Inward cargo showed a drop from 55,108 to 54,664 tons, but the outward returns increased from 46,804 to 51,191. In passengers and troops the inward and outward increases totalled more than 4,000, inward rising from 12,697 to 13,851 and the outward from 15,222 to 18,059. The increase is largely attributable to the large number of vessels which have used the port as a base for cruising operations.

COLD STORAGE FACILITIES.

Steps are to be taken to make better known the cold storage facilities provided by the International Cold Storage Company at Southampton. This much evolved from the annual meeting of the Company at which a diminution in almost all classes of produce stored was reported. The store in the docks is ideally situated to serve its purpose, and the Chairman (Mr. W. Bishop) mentioned that apples from New Zealand had been stored there successfully for five months and were then found to be thoroughly marketable. Not only apples but pears, plums, peaches, grape fruit and even grapes can also be successfully stored there. Storage rates for fruit at Southampton compare very favourably with those charged in the United States and New Zealand, and the fact that fruit stored in this country is available for immediate marketing and places the importer in a position to take advantage of market fluctuations makes storage here more profitable than storage several thousands of miles away from the market. Steamers sailing out of Southampton require an enormous number of eggs, and the use of the stores more extensively by agriculturists to cater for these requirements would, it is thought, prove profitable. With the fruit trade at Southampton growing as it is the store should be used a great deal more than it has been.

MORE CARGOES?

The announcement that the Oceanic Steam Navigation Co., which is controlled by the White Star Line, had acquired from Sir John Ellerman his majority interest in the Shaw Savill and Albion Company did not create surprise in Southampton. The Shaw Savill vessels have used Southampton for some years. There is a very close connection with another Company, the Aberdeen Line, the share capital of which has been jointly held by the Oceanic Steam Navigation Company and Shaw Savill. Developments in connection with cargo traffic from Australia and New Zealand have been evident of late, and there is, indeed, a strong possibility that vessels which have hitherto landed passengers at Southampton and taken their cargoes to London or Hull will discharge, in part at any rate, at Southampton. Two cargo vessels on this run have discharged big cargoes at the port within the last few weeks, and the fact that quite a number of vessels are being constructed for the Australian and New Zealand trade has given rise to the hope that Southampton will be used by the vessels even more frequently in the future than in the past.

A NEW SERVICE.

The White Star Line's new Canadian service, which was inaugurated recently by the sailing of the "Megantic," is interesting for the reason that it recalls another post-war service of the Company which does not now exist. In the latter part of 1922 the White Star Line decided to establish a service between Bremen, Southampton, Halifax and New York, and allocated the steamers "Pittsburg" and "Canopic" to maintain this run. After a time the Continental terminal was altered from Bremen to Hamburg, but the service was eventually terminated in November, 1924. The Line has, however, never previously maintained any direct connection between Southampton and Quebec and Montreal, and for that reason in particular their present venture is interesting.

HALIFAX COLD STORAGE.

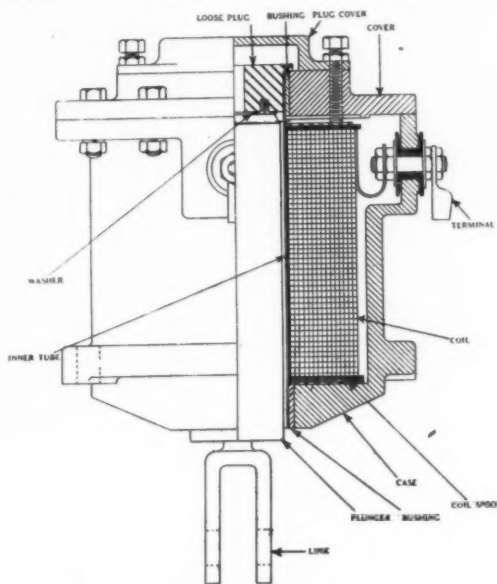
Plans of the Nova Scotia Public Fish and Cold Storage Terminals, Ltd., for a great warehouse to be built at Halifax, N.S., have been disclosed to the Royal Commission on Fisheries sitting at Montreal. Mr. F. W. Cowie, consulting engineer, informed the Commission that this Company, incorporated in Nova Scotia, subsidized by the Dominion Government, and granted a site by the Canadian National Railways, proposed to build and operate a port warehousing and manufacturing terminal at Halifax along the lines of those which have proved so successful at Montreal, New York, New Orleans, Philadelphia, Baltimore and other ports of the Continent.

The cost will approximate \$2,250,000, and the plant will consist of six units: General cold storage; apple and potato pre-cooling and storage; fish cold storage and processing; fish landing; ice making and bait freezing; and fish offal reduction plant for the production of fish meals and oils. The scheme comprehends all the requirements of a modern fish terminal warehouse at Halifax.

Harbour Engineering Notes.

IRON-CLAD SOLENOIDS.

One of the most useful devices to the harbour electrical engineer is the solenoid, which is particularly adapted for operating brakes used in connection with crane and elevator motors. These solenoids are, in fact, designed wherever straight line motion must be produced electrically. Their construction is extremely robust and is quite weather-proof. The diagram (Igranic) illustrates one of the most popular type for this kind of service, which consists of a bobbin-wound coil enclosed in a cylindrical cast iron pot with a tight-fitting cover over its open end. A heavy brass tube, which serves as a guide



Details of Igranic Solenoid Construction.

for the plunger, passes through the coil bobbin with a tight fit in both cover and case. The use of a floating plug eliminates the hammer below and the accompanying shock and noise which are characteristic of solenoids having rigid stops. At the same time the floating plug provides a high pull and a fixed position for the plunger when sealed. In operation, the plunger engages the plug at the end of its working stroke; it continues to rise for the fraction of an inch and carries the plug with it until the stored energy is spent. Both the plunger and plug then drop back until the plug again rests on its seat.

HARBOUR CRANE CONTROL.

An interesting system of control has been developed by the Metropolitan Vickers Electrical Co., Ltd., and applied by the Clyde Crane and Engineering Co., Ltd., for cranes supplied to the South African railways and harbours. This system of control is a combination of electro-magnetic and mechanical control and embodies a speed range between no load and full load very much greater than can be obtained by an ordinary series motor. This advantage is particularly marked at any load less than half load, and where light loads generally constitute the majority of lifts the general improvement in time factor and overall efficiency of the crane is very considerable. Even where heavy loads are dealt with, a considerable saving is effected, due to the increased light hook speeds.

The system of electro-magnetic brake control adopted is such that complete control of the load when lowering is obtained automatically by suitable stepping on the first three notches of the controller without the use of any complicated rheostatic or potentiometer system. With the very light hook speed which is obtained with the type of motor employed, very heavy currents would be developed by the motor when bringing the controller handle back to slow speeds if rheostatic or potentiometer control were employed. With the electro-magnetic system of control these currents do not exist, and the duty of the motor and controller is reduced in consequence.

As an example of the speeds which can be obtained with this type of control, the following particulars are of interest:—

Size of motor 50 h.p., 350/700 r.p.m. Designed to lift four tons at 125 ft. per minute; two tons at 250 ft. per minute and to give a light hook speed of 300 ft. per minute.

The maximum speed is limited to 340 ft. per minute under any conditions, due to the action of a centrifugal brake.

The wide speed range in hoisting is obtained by automatically inserting a comparatively large resistance in series with the shunt field of the motor. This resistance is inserted automatically when the load is half full load or less, and the arrangement is such that the discriminating device which controls this does not come into operation until the last step of the controller is reached.

The discriminating device which controls the speed by load is not connected in circuit on the regulating steps of the controller,

so that the maximum speed of lift obtained on these steps under light load conditions will not exceed about 160 ft. per minute. Under different conditions the actual speed obtained will depend upon the weight of the load and the position of the controller handle.

The electro-magnetic brake which controls the lowering speeds is not in operation as a speed controlling device, except on the first step of the controller. It is inserted on this step in order to give a creeping speed for hoisting slowly under difficult conditions.

A centrifugal brake is operative both on the hoisting and on the lowering side to restrain the maximum speed to within safe limits.

On the lowering side the conditions are rather different, and here the load discriminating device again comes into action on the last notch of the controller. On this notch, therefore, the maximum speed will always be obtained, and this will depend almost entirely upon the setting of the centrifugal brake, and to a slight extent upon the amount of load on the crane hook.

On the first three steps of the controller the electro-magnetic brake is so excited as to obtain a floating characteristic. By varying the amount of series resistance three different speed values are obtained on these steps. These three steps give comparatively low lowering speeds, and on each individual step the speed is to all intents and purposes constant, irrespective of the load being lowered.

On steps 4 and 5 of the controller the electro-magnetic brake is so excited as to lift the brake completely clear, and further resistance is also cut out of the motor armature circuit, thus increasing the lowering speeds. As previously mentioned, the last notch puts into operation the load discriminating device and speeds up the motor to take the maximum lowering speed.

The magnetic brake is equipped with both shunt and series coils. The shunt coil is provided to hold the brake off as and when necessary. The series coil, which, excited with a part of the armature current, is provided to give the floating characteristic of the brake when the shunt coil is unexcited. The series coil only therefore is excited on the first step of the controller on the hoisting side and on the first three steps of the lowering side. On all other steps the shunt coil is also excited and the brake is held definitely off irrespective of the current in the series brake coils.

A centrifugal brake is embodied to limit the speed to a safe value whatever the load and whether hoisting or lowering. In this case the centrifugal brake comes into action at about 300 ft. per minute when hoisting light hook, and limits the speed to about 340 ft. per minute when lowering a load of four tons.

The accelerating relay on the load discriminating device is a plunger type relay whose operating coil is energised by the main motor current. Its function is to act as a load discriminating device and also to cause the motor to accelerate smoothly from full field speed to weak field speed. The accelerating relay does not play any part until the controller is in the last notch in either direction, as its contacts are short-circuited by contacts and fingers on the controller until the last step is reached.

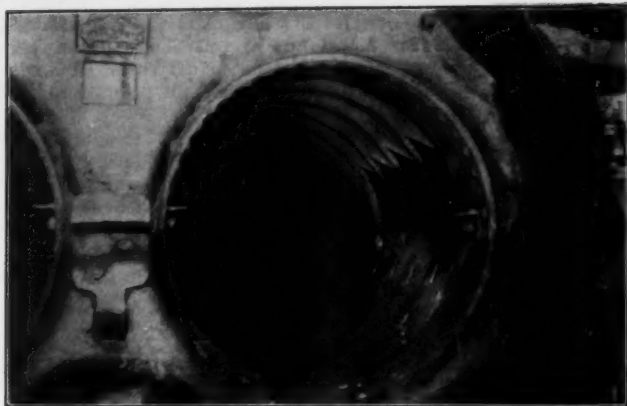
The decelerating relay is similar in construction to the relay just described, except that its contacts are closed when the coil is de-energised. The purpose of the relay is to protect the motor against the rise of voltage which would occur if the controller were brought suddenly from the full speed position, with the motor running with weak field, to one of the earlier notches. This it does by opening the field contactor and weakening the field when the voltage of the motor armature rises above normal. The relay is set to pick up with 20 per cent. over voltage and to release at normal voltage.

INSULATION IN THE POWER PLANT.

The modern power plant, whether a central station or a private generating plant, should no longer have to contend with costly, inadequate and dangerous insulating methods and preparations. In the past, each insulating problem required an individual solution, and in many cases the results obtained were inefficient, to say nothing of the high cost involved. All these undesirable conditions, together with the modern tendency toward standardisation, brought about investigations into new methods and new materials for insulating purposes.

Among the new materials, which promise success, is one composed of sheets of specially treated fabric or paper, which, after impregnation with an organic binder, is subjected to heat and a very high pressure. The material so formed is found excellent for insulating the current-carrying parts of machines and conductors in power houses and sub-stations. It is strong and light, and is little affected by water or oil, and is not attacked by vermin. It is also stated not to soften or deteriorate at temperatures as high as 125 deg. C.

Every conceivable method is now being used to eliminate all live parts from the front of switchboards, particularly in industrial installations where the equipment is operated by semi-skilled labour. It may seem to the casual observer that enclosing with grill work the rear of a switchboard on the face of which there are no live parts, would make switching operations perfectly safe. On the other hand, it is often necessary for wiremen and switchboard attendants to inspect or repair, and sometimes to make alterations in, the equipment inside the en-



Boiler of a Harbour Tug prepared for Repair at Rotterdam.

closure, and it often happens that serious injury or death results from accidental contact with live parts. In these circumstances, the covering of all exposed live parts, such as busbars and connections, is being recommended by electrical engineers. This has been done with insulating tape and cord, but this method involves considerable labour.

Better results are now being obtained by covering these parts with tubing, angles or channels of insulating material, bare rods and wires being covered with tubing, and copper strap and busbars being covered with angles and channels, these shapes being easily prepared in fabric insulation.

High voltage cable joints may also be covered in a similar way, a tube somewhat longer than the bare conductor being slipped over the joint, the conductors then being joined by soldering in a copper sleeve. The three conductors of a three-conductor cable are each enclosed in this way, and then a larger tube, which has also been slipped on the cable before the joint was made, is placed over the joint, completely closing it. Finally, a lead sleeve is slipped over the outside insulating tube and is belled down and wiped to the cable sheath at both ends. The joint is then filled with insulating compound, thus giving a very strong construction, both mechanically and electrically.

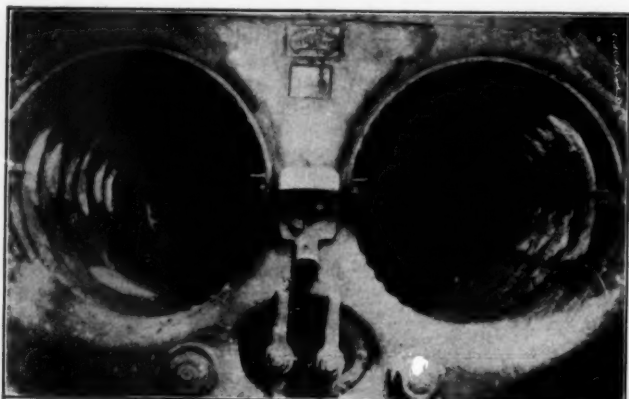
Fabric tubing is also used in the construction of bushings for conductors which pass through walls and floors. For this service tubing of $\frac{1}{2}$ in. wall is found adequate for 23,000 volts, and of $\frac{3}{4}$ in. wall for 11,000 volts.

The old method of taking circuit breaker leads and terminals when the circuit breakers were installed, an operation which required considerable time, is now being replaced by the method of slipping an insulating tube over the leads and connectors. This method is applicable where sharp turns and irregularly shaped connections do not make tapering necessary. The newer method not only requires less work in connection with the installation and removal of circuit breakers, but assures a more satisfactory joint, especially for high voltages and where there is a likelihood of work being done on the connections to the breaker. On some of the larger breakers, a split wooden block is placed on top of the insulating tube, and if any work is to be done on the connector, the block can be removed and the insulating tube then moved up on the conductor.

One big central station is using fabric tubes of large diameter to prevent accidental contact with the exposed part of the transformer terminals. A tube about 8 in. diameter is placed on top of the porcelain bushing of the transformer in such a position as to surround the exposed terminal. The space between the terminal and the tube is filled with insulating compound.

REPAIRING A HARBOUR TUG'S BOILER.

In *The Dock and Harbour Authority* for March, 1927, appeared a short description of some repairs carried out to dredger buckets by means of electric welding, using a special type of electrode, known as the Quasi-Arc. A further interesting repair recently carried out by the same method, using the



The completed job, the new section welded in.

same electrodes, is that to the boiler of a harbour tug at Rotterdam. The first photograph shows the boiler prepared for welding in a new section, while the second illustrates the completed job. This repair was carried out in record time, so that the tug was soon again in commission, while the cost of a new boiler was saved, the welded repair being considered by local engineers as good as new. The repair was subsequently examined by the Dutch Steam Law Authorities and pronounced A1.

SHEET STEEL SWITCHBOARDS.

A development of interest to electrical engineers is the recent introduction of sheet steel switchboard, which seems destined very largely to replace the present slate and marble panels. Lightness, durability and strength, as well as excellent appearance are some of the qualities which recommend this form of construction. In addition to this, each panel with its frame is made of one piece of sheet steel with corners suitably turned and welded, and can be assembled at the works complete with instruments and other apparatus mounted, wired and tested so that the customer is relieved of the trouble of unpacking the individual pieces of apparatus, mounting and wiring. With this new development is also included the assembly of completely enclosed steel switchboards for low tension power and supply distribution. The front of the panel equipment is of sheet steel. Knife switches and carbon circuit breakers are mounted on separate slabs on the rear operated by handles from the front. Removable fuses are situated in steel compartments, thus rendering the whole a completely safe and foolproof equipment.

Launch of the S.S. "Scottish Heather."

New Type of Rudder Fitted.

The steel screw steamer "Scottish Heather," the second of two similar vessels building by Sir W. G. Armstrong, Whitworth & Co., Ltd., for Tankers, Ltd., London, was successfully launched at Walker-on-Tyne on March 3rd. The launching ceremony was gracefully performed by Lady Barnes.

The principal dimensions are as follows: Length between perpendiculars, 440 ft.; breadth, moulded, 56 ft. 8 in.; depth, moulded to upper deck, 33 ft. 11 in.

The vessel is designed to carry a total deadweight of 10,000 tons on a summer draft of 26 ft. 3 in., and the speed on trial when loaded to this draft is 11½ knots.

A special feature of the "Scottish Heather" is the fact that she is fitted with the Oertz type of rudder, this being, we believe, the first new ship to be fitted with the Oertz rudder. The sister ship, "Scottish Chief," launched by Armstrong Whitworth on the 7th February, is fitted with the ordinary type of rudder. The information obtainable regarding the Oertz rudder compared with the ordinary type, on two otherwise similar vessels, will be most valuable. Tankers, Ltd., are to be congratulated on their enterprise in this respect.

The "Scottish Heather" is of the two-deck type, with poop, bridge and forecastle, and is built on the longitudinal system to Lloyd's highest class. The vessel is fitted with a raked stem and elliptical stern, and the oil cargo is carried in nine double compartments having a cargo pump room amidships, extending from side to side of the vessel.

The captain and officers are accommodated in amidship houses on the bridge and upper bridge decks, the engineers on the poop, and the petty officers, seamen and firemen in the forecastle. Oil fuel is carried in the cross bunker at the forward end of the machinery space, and in the deep tank forward. The feed water tank is arranged under the engine and water ballast in the double bottom under the boilers and in the fore and aft peaks. Direct-coupled generating plants are installed, each having a vertical single-cylinder engine, and a multi-polar type dynamo. The vessel is electrically lighted throughout, and is fitted with wireless installation. A horizontal direct acting steam windlass, capable of working the bower cable and bower anchors, is fitted on the forecastle deck. Three steam winches are fitted, one on the fore deck, one on the after deck, and one on the poop deck aft. Electric hydraulic steering gear is fitted on the rudder head, controlled from amidships by telemotor. The cargo oil pumps are two in number, and each is capable of discharging 300 tons of oil per hour. The oil piping is so arranged that the pumps can deal with the oil in every way conceivable. The ballast pump and an oil fuel transfer pump are fitted in a pump room in the fore hold for dealing with water ballast and oil fuel forward.

The propelling machinery consists of a set of direct-acting surface condensing quadruple expansion marine type engines of the most modern and improved design, having cylinders 24½ in., 34½ in., 50 in., 74 in. with a stroke of 54 in. This propelling machinery has been constructed by Sir W. G. Armstrong, Whitworth & Co., Ltd., at their marine engine department. The boilers, four in number, are of the watertube type, arranged for forced draught and to burn oil fuel.

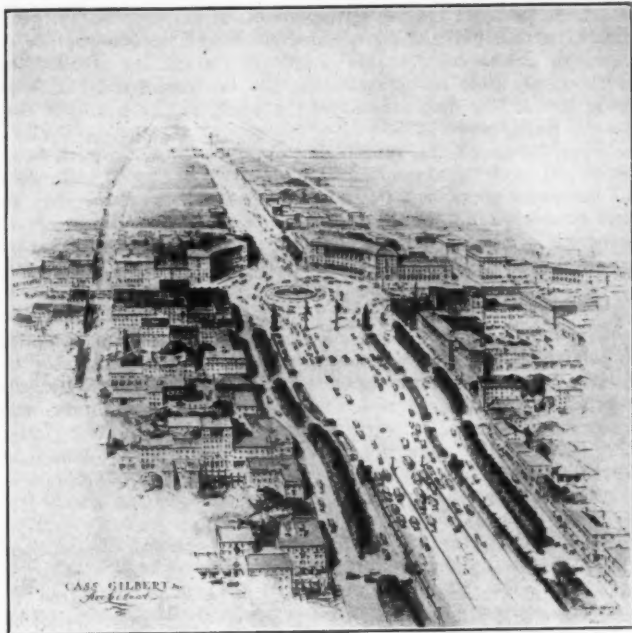
The Port of New York.

Important New Bridges under Construction. Rail Rates and American Port Competition.

(Concluded from page 186.)

IRON AND STEEL RATE DIFFERENTIALS.

The 1926 Annual Report referred to the intervention of the Port Authority in a case pending before the Interstate Commerce Commission (American Motor Body Corporation v. B. & O. R. R., Docket No. 18031), involving a rate reduction on iron and steel articles from the Western Pennsylvania and



Fort Lee Approach Plaza, Hudson River Bridge.

Ohio producing districts to Philadelphia. The report of the Examiner in this case was issued recommending a 10 per cent. reduction in the Philadelphia rates without changing the New York rates.

Although the report stated that all parties to the proceedings desired no change in the existing relation of Philadelphia rates to New York rates, and that there was no evidence in the record upon which to base such a change in relationship, the examiner recommended new rates which would result in a preference of 3 to 4½ cents per 100 pounds more in favour of Philadelphia than at present.

To preserve the competitive status of manufacturers in this port district, the Port Authority filed an exception to the Examiner's report, asking the Commission to maintain existing port relationships. Final decision is awaited.

GREAT LAKES GRAIN DIFFERENTIAL.

The 1926 Annual Report noted a recommendation by Examiner Hosmer in the Boston Grain Differential Case (I. C. C. Docket No. 13548) that differentials on ex-lake grain be abolished and rates on such grain from Buffalo to New York be reduced to the same level as to Philadelphia and Baltimore. This reduction of ½ cent per 100 pounds would have meant a saving of \$236,000 per annum in freight cost on grain moving from the Lakes to New York.

We regret to report that the final decision of the Commission, issued May 9th, 1927, reversed the examiner's recommendation,

leaving the rates at their present levels. Up to the present time there has been no indication that local grain interests contemplate further action.

HELL GATE BRIDGE ROUTE.

The Annual Report for 1926 reviewed the activity of the Port Authority in regard to the use of the New York Connecting Railroad and the Hell Gate Bridge for western and northern traffic to and from Long Island. The matter was laid before the Interstate Commerce Commission and the Public Service Commission of New York in a series of joint hearings during February, March and April, 1926.

In preliminary reports dated February 10th, 1927, Examiner E. L. Beach, for the Interstate Commerce Commission, and Hearing Deputy W. E. Griggs, for the New York Public Service Commission, proposed findings that would require establishment of joint rates and through routes on inbound traffic to Long Island, but would not require similar routes and rates on outbound traffic from Long Island. The conclusion that outbound through rates should not be required was based on the contention that such routes would short-haul the Long Island and Pennsylvania Railroads. The choice between using the Hell Gate Bridge or the carfloat route was left optional with the carriers, depending on their own judgment as to the most satisfactory operation.

The Port Authority took vigorous exception to the recommendations, both in a brief of exceptions and an oral argument before the Interstate Commission on May 16th, 1927. The argument of counsel combated the contention that the establishment of outbound through rates and routing would short-haul the Pennsylvania Railroad, and that the joint use of facilities would retard terminal development, and emphasised the contention that the Hell Gate Route was entirely adequate to handle the New York Central traffic. The paramount issue of the case may be summed up in the words concluding the brief of exceptions:

If the Hell Gate Bridge is not to be regarded as a facility for serving the needs of the public, but is to be regarded as a private facility to be given only such restricted use as the selfish requirements of the Pennsylvania and the New Haven may dictate, then these complaints should be dismissed. If, on the contrary, shippers and receivers of freight on Long Island are entitled to adequate transportation service regardless of the ownership of the facility, and if consideration is to be given to the declared policies of the two States and of Congress, then the relief sought in the complaints must be granted. The determination of the issues must necessarily hinge upon the determination of this question of public policy.

Final decision by the Interstate Commerce Commission is expected at an early date.

During the past year the New York, New Haven and Hartford Railroad (New York Connecting Railroad) and Long Island Railroad have completed the electrification of their main freight lines from Oak Point to Bay Ridge, thereby enabling the operation of through electric freight trains from Cedar Hill to Bay Ridge and vice versa, by-passing the Oak Point (Bronx) classification yards of the New Haven. Formerly engines were interchanged at Oak Point, steam to electric, compelling the yarding of trains en route. The avoidance of this has had the effect of relieving pressure on the Oak Point Yard facilities of the Hell Gate Route, to the advantage of traffic movement such as the Port Authority purposes. It has also made possible doubling of the train load over the New York Connecting Railroad, thus achieving increased economy of operation, with, ultimately, fewer train movements.

CONSTRUCTIVE AND OFF-TRACK FREIGHT STATION INVESTIGATION.

A matter directly affecting the comprehensive plan and the terminal services of the carriers in the Port District is involved in an investigation, which the Interstate Commerce Commission has started on its own motion, of the trucking services of the carriers at New York, including the services and



The proposed Kill van Kull Bridge between Bayonne, New Jersey, and Port Richmond, Staten Island.



The Elizabeth-Howland Hook Bridge between Elizabeth, New Jersey, and Howland Hook, Staten Island.

facilities embraced in their constructive freight stations, off-track stations and trucking in lieu of lighterage.

At the present time three of the carriers whose lines terminate in New Jersey have established off-track freight stations on Manhattan Island similar in principle to the proposed union inland freight stations of the Port Authority except that they are individual stations instead of being universal.

Seven carriers are handling carlot freight through so-called constructive stations on Manhattan which are really not stations at all but simply a service whereby freight is trucked direct from the door of a car on a New Jersey team track to the store door in New York. The railroad pays the cost of getting the truck across the river and the merchant pays for the balance of the haul to his store. This service is at the option of the shipper or consignee.

Almost all the carriers have provisions in their tariffs whereby, at their own option they may truck freight to waterfront points in lieu of performing lighterage service. Such consignments are often forwarded to establishments located back of the waterfront, the consignee or shipper in such cases paying for the extra trucking cost between his nearest waterfront point and his place of business.

All of these circumstances and conditions, including rates, charges, rules and regulations, surrounding these arrangements, are under investigation by the commission in this proceeding (I. C. C. Docket 19750). As any order issued in this matter is likely to have an important bearing upon the terminal service of the port district, the staff is preparing to participate in the proceedings. The date of the first hearing has not yet been announced.

INTERSTATE BRIDGES.

Very substantial progress was made in 1927 in building the interstate bridges included within the programme with which the Port Authority has been charged by the Legislatures of the two States.

This programme embraces four projects, namely, a bridge across the Arthur Kill between Perth Amboy, New Jersey, and Tottenville, Staten Island; another over the Arthur Kill between Elizabeth, New Jersey, and Howland Hook, Staten Island; the Hudson River Bridge between Fort Washington in Manhattan, City of New York, and Fort Lee, New Jersey and, finally the bridge to span the Kill van Kull between Bayonne, New Jersey, and Port Richmond, Staten Island.

The four bridges, when completed, will represent an investment of approximately one hundred million dollars of which nearly 50 per cent. has been spent or contracted for.

The Bayonne Port Richmond Bridge has just been financed. The preliminary studies have been brought to a conclusion and the War Department has given its approval of the plans.

ARTHUR KILL BRIDGES.

Progress of construction on these two bridges during the past year has been eminently gratifying. The first of the construction contracts was let as late as the Autumn of 1926, yet the work remaining to be done should be completed and the structures opened to traffic during the Summer of 1928, instead of early in 1929, as scheduled. Both bridges involve an estimated cost of \$18,000,000.

Work on the two bridges has been proceeding simultaneously and both will on completion be opened to traffic at about the same time. All principal portions of the structures have been contracted for.

All of the substructure contracts, embracing approximately 147,800 cubic yards of concrete masonry, were completed in the Summer and Fall, or about four months ahead of schedule, and their actual cost is well within the estimated amount.

The superstructure work, involving the fabrication and erection of 27,764 tons of steel, both because it was possible to begin operations earlier than anticipated and because of the rapid progress made by the contractors, is also well ahead of schedule. Practically all of the steel has been fabricated and all but a very small portion erected and riveted.

The two halves of the river span of the Elizabeth-Howland Hook Bridge were joined on December 6th, 1927. All steel

members of that bridge are now erected and fully riveted, about five months ahead of schedule.

The erection of the steel work on the "Outerbridge Crossing," the Perth Amboy-Tottenville bridge, is also nearing completion, being only about one month behind that of the Elizabeth Howland Hook Bridge in spite of the much larger tonnage involved.

The contracts for the concrete abutments and earth fills at the plazas were awarded at an early date so that the fills would be given ample time to settle and become solidified before the placing of the pavements. This filling work is practically all completed, but a considerable portion of the concrete work for the abutments will have to be deferred until Spring on account of weather conditions.

The contracts for the concrete decks were let in the early Autumn, so that the contractors could complete as much of the work as possible before setting in of winter weather. It was not expected that placing of concrete would be done before the opening of the construction season in the Spring of 1928, but with ample time for preparation it is expected that rapid progress will be made then and the work will be complete early in the Summer of 1928.

There remain a few minor contracts yet to be let, such as the electrical work, field operation buildings, tool booths and paving of the plaza areas, but these can all proceed simultaneously and can be completed by the time the major operations of the concrete deck are completed. These contracts will involve approximately \$750,000.

HUDSON RIVER BRIDGE.

The money from the sale of the first instalment of bonds for the Hudson River Bridge became available about January 1st, 1927. Immediately thereupon active construction work was started by the making of the final borings to determine more fully the nature of subsurface conditions. The building up of the necessary organisation to prepare the contract plans and specifications and carry on the engineering functions in connection with the construction of the bridge was also started at once.

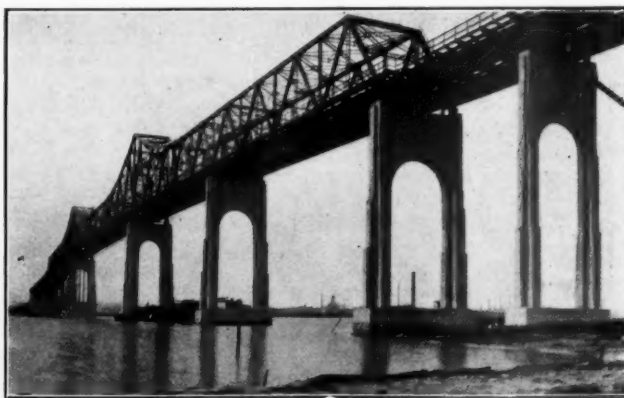
During the year 1927 five contracts for construction work, of an aggregate amount of approximately \$24,357,000 were awarded. This amount represents 64 per cent. of the cost of all construction required to open the bridge to traffic. Contracts let embrace the fabrication and erection of all steel work, including cables, etc.

Further intensive study has been given to all phases of the project, the analysis of the traffic, both present and anticipated; the provisions necessary for accommodating the anticipated volume of bridge traffic, at both ends, the rights and wishes of the respective communities, and the innumerable engineering problems in connection with the design and construction of a structure of this magnitude. Frequent conferences were held with representatives of the City of New York with a view to solving the complex problem of planning adequately the approach and street connections in Manhattan. It is evident that problems of such far-reaching ramifications cannot be solved completely in so short a time, but it is gratifying to be able to report that their solution has progressed so that construction work at both ends of the bridge can proceed without delay.

In New Jersey the problems of right of way and suitable agreements with the public bodies have been relatively simple. Mutually satisfactory arrangements have been concluded with the Palisades Interstate Park Commission for the purchase, or lease for temporary purposes, of properties within their jurisdiction.

A satisfactory agreement has been concluded with the Borough of Fort Lee. A large portion of the necessary private property has been acquired for the approaches on both sides of the river.

The construction work on the contracts so far let is progressing very satisfactorily and is well within the schedule set up for it.



The Outerbridge Crossing between Perth Amboy, New Jersey, and Tottenville, Staten Island, now nearing completion.

The foundation of the New Jersey tower involved the construction of two open cofferdams, the largest and deepest open cofferdams in water ever undertaken in the history of bridge work. In view of the magnitude and the unavoidable risks involved in this work most careful study into all the details has been given by both the contractor and the staff of the Authority.

In their deepest portion the cofferdams will have a double wall of sheet steel piling, divided by transverse sheet piling walls, into pockets about 8 ft. wide by 10 ft. long. These pockets have been dredged and cleaned to the rock and filled with concrete. In the parts of the cofferdams involving less depth, only a single wall of steel sheet piling is used. In both directions the walls of the cofferdams are thoroughly braced so as to withstand the great outside pressure.

After the cofferdams were completed and all of the silt and mud overlying the rock was removed, the rock itself was given close inspection and every part of it was removed which seemed insufficient for the great load which the bridge will ultimately impose upon it.

The work of placing the concrete base on the rock inside the cofferdam is now proceeding and is expected to be completed before the Spring of 1928, ready for the erection of the steel towers.

The approach to the bridge east of Hudson Terrace, Fort Lee, and the tunnels for the New Jersey Anchorage involve the excavation of approximately 200,000 cubic yards of hard trap rock forming the Palisades. The rock, as it is removed from the cut, is crushed and disposed of by the contractor for use in road building and concrete work. This work is also proceeding satisfactorily.

The contracts for the steelwork, representing two of the largest single contracts for bridge work ever let and involving the fabrication and erection of approximately 400,000 tons of steel, were awarded on October 3rd, 1927. The contractors are now actively engaged in perfecting their working plans and installing the additional equipment required to take care of the unusual tonnage and proportions of the work. The rolling of steel for the towers has already started.

The present plans for this project contemplate providing a forty-foot roadway in the centre of the bridge and a sidewalk on each side of the bridge to care for traffic initially. When the traffic develops to the extent that these provisions become insufficient to accommodate it, two additional twenty-four foot roadways will be constructed, one on each side of the central roadway. There will also be added later when needed a lower deck which will provide for two, four or six lines of rapid transit tracks or bus traffic as may be required. It is expected that, unless unforeseen difficulties shall arise, the bridge will be open for the initial traffic by 1932. The estimated cost of the structure completed for actual traffic is \$60,000,000.

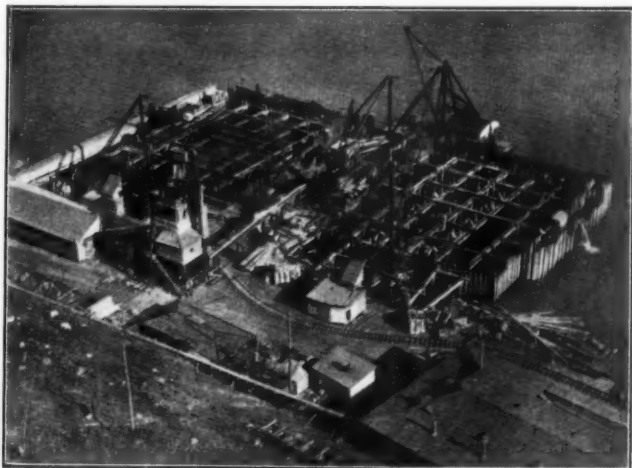
TOWING COSTS TO HUDSON RIVER BRIDGE REDUCED.

The Hudson River Bridge site is outside of free lighterage limits and construction materials delivered at the site by railroads are assessed an extra towing charge. This charge formerly was \$47.00 per tow.

Our Traffic Department undertook negotiations with the trunk line carriers and secured a reduction to \$35.00 resulting in the saving of \$12.00 per tow on an estimated volume of some 400,000 tons of material. This reduced rate went into effect June, 1927.

KILL VAN KULL BRIDGE.

During the year 1927 the necessary preliminary studies and surveys for the Kill van Kull Bridge were continued and towards the end of the year had progressed to a point where definite conclusions could be drawn regarding the feasibility of the project and the steps to be taken toward its definite financing.



View of Cofferdam for Foundation, Hudson River Bridge, Jersey Side.



Typical Cut through the Palisades, Fort Lee; 200,000 cub. yds. of hard trap rock being excavated in making an approach to the Hudson River Bridge and Tunnels for the New Jersey Anchorage.

The work done comprised additional traffic studies and revision of the traffic estimates, more complete topographical surveys, borings and sinking of test pits to determine depth and character of rock, complete revision of the design work and cost estimates, and additional architectural studies. Informal conferences have been held with representatives of the respective municipalities with a view to securing their co-operation and eventual approval of the approach plans. The properties required for right of way were reappraised by the Real Estate Department and the preparation of property maps is well under way.

Application to the Secretary of War for permit to construct the bridge was made, and after a public hearing the plans were approved.

The conclusions arrived at in the tentative report are substantially corroborated by the additional studies. As a result of discussions with the Transit Authorities in the two States, more particularly the North Jersey Transit Commission and the Board of Suburban Transit Engineers, it has been decided to recommend that the bridge be designed so that it may be opened for a four-line vehicular roadway, but that it be made wide enough and strong enough so that later at least three additional roadway lanes may be added, or in their place, two rapid transit tracks.

This enlargement of the traffic capacity, which was originally assumed for six lane vehicular traffic, has added approximately one and a half million dollars to the estimated initial cost of the bridge.

The following is a brief description of the plans as now developed subject to such modifications as in the course of further studies may be found necessary or desirable.

LOCATION OF BRIDGE.

The legislative acts of the States of New York and New Jersey leave to the Port Authority the selection of the location of this bridge.

A careful study of the geographical conditions on both sides of the Kill indicates that location near the westerly side of Bayonne opposite to Port Richmond on the Staten Island is most suitable.

The location is well chosen with respect to both topographical and geographical conditions.

The bridge will connect with numerous highway arteries on both sides of the Kill van Kull. Extensive traffic studies conducted over a period of approximately two years show conclusively an urgent demand for an interstate highway crossing in this location.

On the New Jersey side the bridge will connect with the Hudson Boulevard, permitting its use by vehicular traffic from all points in Northern New Jersey and also will be a direct connecting link between Manhattan and Staten Island via the Holland Tunnel and Hudson Boulevard. The Port Richmond terminus will connect with all the main highways on Staten Island through which highways traffic will reach points east, west and south on Staten Island, and on the mainland via the bridges across the Arthur Kill at Elizabeth and Perth Amboy.

SIZE AND TYPE OF BRIDGE.

The present plan of the bridge provides for an arch type as it combines economy with best appearance and greatest rigidity. Both this type and a suspension type structure, however, will be studied in more detail before a definite decision is reached.

The present physical specifications of the proposed bridge are:

	Feet
Length of river span	1,685
Total length of main bridge over abutments	1,940
Total length of bridge and approaches between plazas	6,380
Maximum clear height above water of centre of bridge	150
Maximum clear height above water over a 1,000 ft. channel	135
Height of main arch above water	317
Width of floor (over all)	95

TRAFFIC CAPACITY.

The bridge has been designed without deck. It has been designed to accommodate eventually six or seven lanes of vehicular roadway. The bridge and approaches will also carry footwalks for pedestrians. The initial capacity, however, will be for four lanes of vehicular traffic, the traffic study indicating that the initial capacity will be ample for many years after the opening of the bridge. The bridge will be constructed strong enough, however, so that it will carry, in addition to the initial four lane roadway, two rapid transit tracks, it being assumed that the excess capacity would be so utilized in case the carrying of the rapid transit across should become desirable before additional vehicular capacity is needed.

ESTIMATED COST.

Estimates indicate that the bridge, including approaches, can be built and opened with capacity of four lanes of vehicular roadway at a cost not to exceed \$15,500,000. This sum includes cost of construction, engineering, administration, real estate, and interest during construction. Estimates are based on prevailing prices of labour and material with a fair marginal allowance for contingencies. No provision has been made for the transit facilities or additional roadways, but, if and when needed, sufficient funds will be available from surplus tolls and charges to provide for this improvement.

CONSTRUCTION PROGRAMME.

Funds from the sale of bonds being now available construction work can commence in the Summer of 1928. It is estimated that the bridge can be opened for traffic in 1932.

ESTIMATED BRIDGE TRAFFIC.

Based on comprehensive and carefully conducted traffic studies it is believed that the volume of yearly traffic accommodations of the bridge will be approximately as follows:

Year	No. of Vehicles	No. of Passengers in Vehicles	No. of Buses	No. of Passengers in Buses
1932	948,400	1,422,600	78,700	1,573,400
1933	1,090,300	1,635,500	90,400	1,808,900
1934	1,250,400	1,875,600	103,700	2,074,000
1935	1,398,100	2,097,100	116,000	2,319,500
1938	1,906,500	2,859,700	158,100	3,162,900
1943	2,868,300	4,302,500	237,900	4,758,700
1950	3,943,500	5,915,200	327,100	6,542,500
1960	4,682,000	7,023,000	388,400	7,767,700

The two counties on each side of the bridge, from which it can expect most of its local and regular traffic, have a combined area more than five times as great as Manhattan, but contain at present a population which is only one-third of that of the most intensely developed sub-division of the Port District. This simply indicates that the Borough of Manhattan, Hudson County and Richmond Borough will be effectively connected so that the pressure in the first will tend to be relieved by finding outlet in others. These because of their proximity,

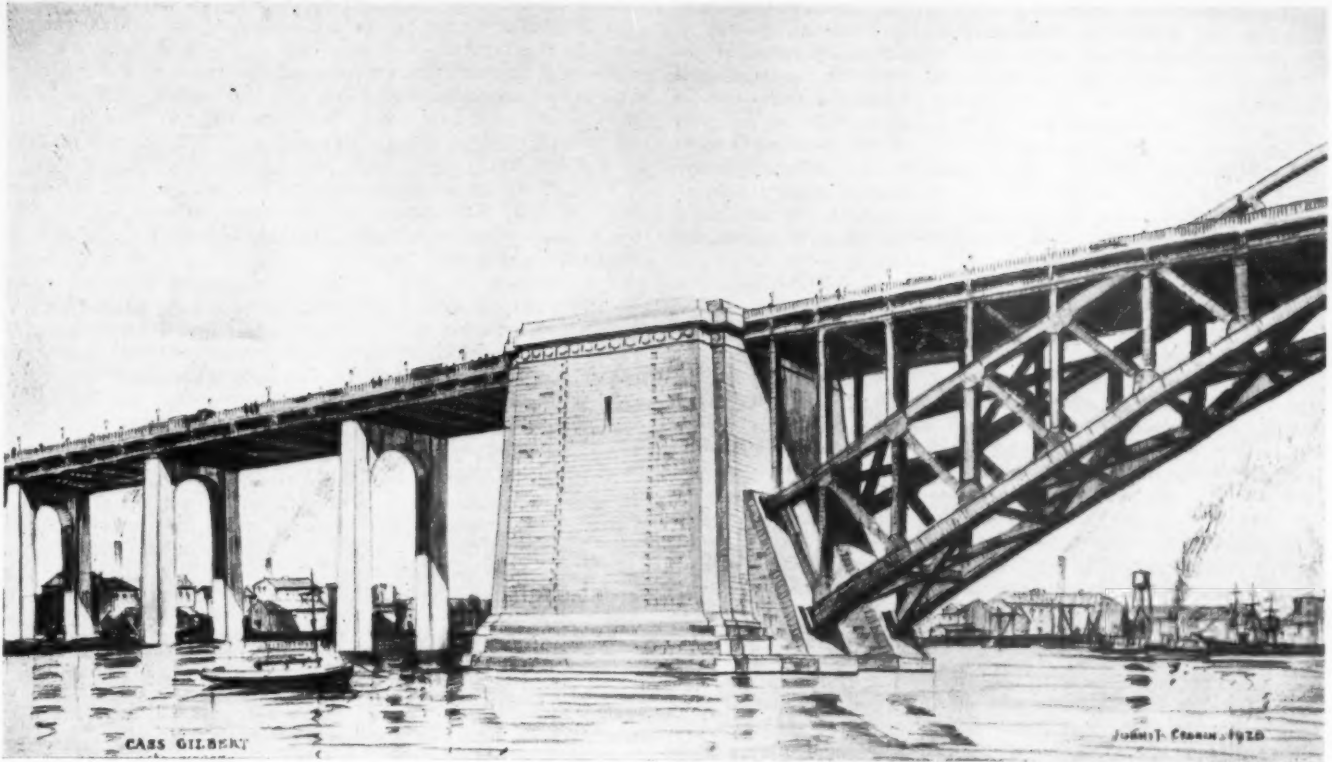
their great area, their economic, social and political importance, are certain to develop with a rapidity that will tend to equalise the distribution of population within the Metropolitan District.

SUBURBAN TRANSIT.

The problem of providing adequate passenger transportation for the thousands of daily riders from and within the suburban districts centreing about the City of New York is becoming acute. The situation is intensified by the fact that nearly half of these travellers travel within limited rush hour periods, morning and evening, and these daily, periodic surges of humanity must flow through channels that have other intensive transportation demands. Inbound, long distance passenger trains generally arrive at terminals during the morning commutation hours. In the evening the vanguard of a fleet of fast freight trains closely pursues the commuter to and through his suburban community. In New York City he is carried back and forth in a local subway system already operating to capacity and whose load is even now increasing at the rate of 200,000 riders a day. Local transit agencies have been coping with this problem for several years in their respective districts. In New York City there has been much new construction ever under way. In Northern New Jersey and Westchester County transit commissions have studied and reported on their respective problems. There has existed, until this time, however, no concerted attempt to co-ordinate the inter-state and regional phases of a problem whose solution can only be attained by the most comprehensive study and the broadest lines of planning. It is the lack of inter-state consideration that has been in no small measure responsible for the unbalanced development of residential areas in the different sectors of the port. It is the cause of congested terminals and crowded trains of the New York carriers. General relief can be obtained only through regional planning of a comprehensive suburban transit system. The Port Authority took an active part in the contemplation of passenger problems immediately following directions from the State of New Jersey under chapter 277 of the Laws of 1927. This was supplemented by requests from the supervisors of Westchester County, N.Y., that the problem be considered by the Port Authority in its larger aspects. The Port of New York Authority was directed by the New Jersey statute to consider the plans, studies, reports and data prepared by other agencies, such as the New York State Suburban Passenger Transit Commission, the Westchester County Transit Commission, the Transit Commission, State of New York, the North Jersey Transit Commission, the Regional Plan of New York and Its Environs, and any other agencies which have dealt with and studied this problem, and shall, after such study, make a report to the Legislatures of the two States, in which shall be submitted such amendments to the existing comprehensive plan for the development of the transportation facilities of the district or such additional or supplementary legislation as may be necessary to effectuate a comprehensive inter-state and suburban



View from Manhattan and Hudson River Bridge and Approach.



Abutment Pier, Bayonne—Port Richmond Bridge.

passenger transportation system for the Port of New York District." The Port of New York Authority is required also to submit, as a part of its report, a legal plan for the financing of the said improvements "through the Port of New York Authority as the corporate municipal instrumentality of the two States or otherwise."

Meetings were held in the late spring with the North Jersey Transit Commission and later with the Westchester officials. The best approach to a regional solution of the suburban transit problem was seen to be through a centralised group or board consisting of engineering representatives from the railroads and each of the sectors of the port district. To effectuate the organisation of such an engineering board, it was agreed that the Port of New York Authority, being a bi-state agency interested in improvements on both sides of the Hudson River, would be the proper party to extend invitations to the public bodies to join in setting up the Suburban Transit Engineering Board. Accordingly the following were invited:—

North Jersey Transit Commission	New Jersey Sector
Board of Supervisors, Westchester County	Westchester Sector
Boards of Supervisors, Nassau and Suffolk Counties	Long Island Sector
Board of Transportation	New York City
Association of Railroad Executives	Railroads
The Port of New York Authority	Port of New York

The response was whole hearted and immediate, the following engineers being designated to represent their respective interests upon the Board:—

New Jersey Sector.—Daniel L. Turner, Consulting Engineer, North Jersey Transit Commission.

Westchester Sector.—Chas. MacDonald, County Engineer, Westchester County.

Long Island Sector.—W. Fred Stark, County Engineer, Nassau County, and Albert O. Smith, County Superintendent of Highways, Suffolk County.

City of New York.—Robert Ridgway, Chief Engineer, Board of Transportation.

The Port of New York Authority.—Billings Wilson, Deputy Manager.

Railroads.—R. E. Dougherty, Engineering Assistant to President, New York Central Railroad, representing New York Central Railroad, New York, New Haven and Hartford Railroad, New York, Ontario and Western Railroad. R. C. Falconer, Engineering Assistant—Vice-President, Erie Railroad, representing Erie Railroad, Delaware, Lackawanna and Western Railroad, Lehigh Valley Railroad. R. K. Rochester, General Manager, Long Island Railroad, representing Pennsylvania Railroad, Central Railroad of New Jersey, Long Island Railroad, Baltimore and Ohio Railroad.

It is our opinion that, in the long run, the greatest progress will be attained by having this Engineering Board undertake the responsibility for the preparation of the engineering section of a comprehensive suburban transit plan for the entire port district. The Board is now functioning. It has designated sub-committees for each sector of the port district composed of representatives of local agencies and local carriers, which will submit sector plans for co-ordination by the Board into a regional engineering plan. The Board's report will be used as a basis for the legal and financial portions of the comprehensive

plan to be later submitted to the Legislatures of the two States by the Port Authority.

This enlargement of our duties has necessitated creating a Suburban Transit Division on our staff headed by a competent transit engineer and including the necessary technical assistants. As part of its contribution to the work of the Suburban Transit Engineering Board the Port Authority has agreed to make its Suburban Transit Division available for conducting such investigations and studies and preparing such plans and reports as the Board may require. Mr. Glenn S. Reeves, Assistant Chief Engineer of the North Jersey Transit Commission, was selected to become Transit Engineer, heading our Suburban Transit Division. He is also acting in the capacity of Secretary for the Suburban Transit Engineering Board.

The work of this Division, since its organisation July 1st, 1927, has been divided into two parts, i.e., the collection and analysis of passenger statistics for the entire port district, and the planning and investigation of the routes for the comprehensive suburban transit plan. The studies and data of the North Jersey Transit Commission and the former Westchester County Transit Commission have been availed of. The railroads have generously contributed all available pertinent passenger traffic statistics.

Early analyses indicated that the suburban passenger transit problem is not merely a North Jersey problem, a Westchester problem or a Long Island problem, it is decidedly a regional, and largely inter-state, problem as the accompanying plate shows:—

THE PORT OF NEW YORK AUTHORITY			
<p>1. WRITE IN THE BLANK BELOW</p> <p>1. START THIS TRIP FROM</p> <p>2. WRITE IN THE BLANK BELOW</p> <p>MY ULTIMATE DESTINATION FOR THIS TRIP IS</p>		<p>3. CHECK (✓) ONE SQUARE BELOW</p> <p>THE KIND OF TRIP I MAKE</p> <p>4. CHECK (✓) ONE SQUARE BELOW</p> <p>AFTER LEAVING THE RAILROAD TO REACH MY DESTINATION, I USE</p>	
<p>5. CHECK (✓) ONE SQUARE BELOW</p> <p>1. TO REACH THE RAILROAD STATION</p> <p>6. CHECK (✓) ONE SQUARE BELOW</p> <p>1. TO LEAVE THE RAILROAD AT</p>		<p>7. CHECK (✓) ONE SQUARE BELOW</p> <p>1. TO REACH THE RAILROAD STATION</p> <p>8. CHECK (✓) ONE SQUARE BELOW</p> <p>1. TO LEAVE THE RAILROAD AT</p>	

It was apparent at the outset that the boundaries of the Port of New York District as now defined by law for purposes of freight terminal development were too limited for suburban transit planning. A study of the sources of commutation traffic and the reasonable limits of commuting activity decided the Engineering Board to consider a much larger area. The district finally adopted for study has been divided into three sectors as follows:—

	Land Area Sq. Miles	Population 1930 U.S. Census	Population 1926—Estimated
New Jersey Sector	2,460	2,394,769	2,730,700
Westchester Sector	592	442,448	554,000
Long Island Sector	416.6	151,328	263,300
New York City	299	5,620,048	5,924,500
	3,767.6	8,608,593	9,472,500

To meet certain planning needs the Suburban Transit Engineering Board recommended that a railroad passenger traffic count based on origin and destination be made in the Westchester and Long Island sectors similar to the one made in New Jersey by the North Jersey Transit Commission in September, 1924. With the spirited co-operation of the New York suburban railroads this was done on Wednesday, October 26th, 1927, and covered all Manhattan-bound railroad passengers for 24 hours from the two sectors. Passengers on all ferries leaving Staten Island were also clocked. More than a quarter of a million, specially printed, tabulating machine cards, as reproduced elsewhere in this report, were distributed to the riders on some 900 trains through the splendid co-operation of railroad train crews and special personnel furnished by co-operating agencies.

The returns from this count were most gratifying, being higher than might have been expected. Over 40 per cent. of the cards were returned. Because of the great volume and variety of the data it will be several months before a complete analysis can be made.

Meanwhile the sector committees of the Suburban Transit Engineering Board are busily engaged in studying all plans of the local agencies within their respective districts. The innumerable technical ramifications are receiving expert attention. The entire Board is meeting at regular intervals to insure co-ordination of all committee activities, step by step. Our own transit staff is progressing in its analytical work with all possible dispatch and in addition has a staff of expert engineers engaged on analyses of types of equipment and designs and estimates of typical subway and tunnel structures in anticipation of reports from the sector committees on amount and location of new facilities necessary. The results of these various studies have not progressed to a point where they can be included in this report.

CONCLUSIONS.

The studies and planning work now under way by the Suburban Transit Engineering Board, resulting already in the whole-hearted co-operation of the various transit agencies in the Port District, should be continued with the same vigour that has marked its progress to date. The helpful spirit of co-operation prevailing among the associated interests should be fostered as it is bound to result in definite and tangible accomplishments.

The conclusions contained in the sub-committee reports embodied in the preliminary report of the Suburban Transit Engineering Board of January 11th, 1928, and, annexed hereto, are sound. They point out the need for further study of the following matters:—

(a) A distribution system in New York City for the daily riders from the suburban districts outside of the city limits.

(b) The extension of this distribution system across the Hudson River to connect with the sources of traffic in New Jersey.

(c) Transfer stations where necessary for the interchange of passengers between the existing suburban railroads and this distributing system.

It is recommended that the Port Authority continue its support of the Suburban Transit Engineering Board for the purpose of assuring the continuance of the studies which that Board has under way.

Concurrent legislation by New York State in support of this programme would be helpful.

FINANCIAL OPERATIONS.

The Port of New York Authority is required to bring about the improvements which it undertakes under the mandate of the States of New York and New Jersey without increasing the burden of the taxpayer.

It must, necessarily, expend large sums of money to create the facilities which are on its programme, but it must raise its funds on its own credit. It is not limited as to the amounts of the securities it issues as are municipalities and other political sub-divisions, but must meet debt charges and administration and maintenance out of the earnings of its facilities. In other words, it must be governed by the law of economic practicability.

Port Authority bonds are free of tax in New York and New Jersey and exempt from Federal taxation. The securities already issued are declared by statute to be legal for investment by savings banks, insurance companies and fiduciaries in the two States. But they are not supported by taxation. The compact between the two States expressly withholds from the Port Authority power to levy taxes or assess for benefits. It is also forbidden to pledge the credit of the States which created it.

In directing the Port Authority to construct the four bridges now on its programme New York and New Jersey provided funds in equal amounts for study purposes. They also agreed to advance equal sums of money in aid of construction in each instance.

Towards the construction cost of the bridges over the Arthur Kill from Perth Amboy, N.J., to Tottenville, S.I., and

from Elizabeth, N.J. to Howland Hook, S.I., estimated to cost \$18,000,000, the States are advancing \$2,000,000 each, a total of \$4,000,000.

Toward the construction cost of the Hudson River Bridge from Manhattan Borough, City of New York to Fort Lee, N.J., estimated to cost for opening to initial traffic \$60,000,000, the States are advancing \$5,000,000 each, a total of \$10,000,000.

Toward the construction cost of the bridge from Bayonne, N.J., to Port Richmond, S.I., estimated to cost \$16,000,000, the States are advancing \$2,000,000 each, a total of \$4,000,000.

The advances in every instance are payable in equal annual instalments over a period of five years.

Both study funds and advances in aid of construction constitute a debt which must be repaid with interest to the two States, out of the earnings of the bridges from tolls or otherwise. The bonds, however, have the first lien on the bridge revenues and the claim of the States is secondary.

MARKET FOR PORT AUTHORITY BONDS.

A growing demand by investors and a broadening market for Port Authority bonds accompanied by a gradual but constant improvement in prices therefor mark the history of these securities since the first issue. Ease in the money market has, of course, been one factor, but it is reasonable to assume that growing confidence in the Port Authority's method of financing and the soundness of its projects have had due weight in the situation.

The first issue of \$14,000,000 Port Authority Bridge bonds (Series A), bearing $4\frac{1}{2}$ per cent. interest, was sold on March 4th, 1926, at 97.25 per cent. of par to a syndicate headed by the National City Company of New York.

The price paid by the syndicate showed an interest cost to the Port Authority for the proceeds of the bonds of 4.76 per cent.

These bonds were disposed of to obtain funds for the construction of the bridge from Perth Amboy, N.J., to Tottenville, S.I., and for the bridge from Elizabeth, N.J., to Howland Hook, Staten Island, both structures being over the Arthur Kill and now approaching completion. These are serial bonds, first retirement date being March 1st, 1932, and the last March 1st, 1946, callable on or after March 1st, 1936, at 105 per cent. of par.

The next issue of Port Authority Bridge bonds (Series B), in amount \$20,000,000, and bearing 4 per cent. interest provided funds for the first stages of construction of the Hudson River Bridge. They were sold to a syndicate headed by the National City Company at 95.637 per cent., of par, representing an interest cost on the proceeds to the Port Authority of 4.242 per cent. These are serial bonds, the first retirement date being December 1st, 1936, the last December 1st, 1950, and are callable on or after December 1st, 1936, at par. The bonds of Series A were placed on sale to the public by the syndicate on March 8th, 1926, and immediately disposed of at par. The bonds of Series B were sold by the syndicate to the public on a 4.20 per cent. yield basis.

The following table exhibits the appreciation in value in the bonds as shown by sales during the year 1927:—

	4½ p.c. Series A Yield Basis p.c.	4 p.c. Series B Yield Basis p.c.
January	4.30	4.20
February	4.30	4.20
March	4.30	4.15
April	4.25	4.15
May	4.25	4.15
June	4.25	4.20
July	4.25	4.15
August	4.25	4.15
September	4.15	4.10
October	4.15	4.10
November	4.10	4.10
December	4.05	4.00

On January 5th of the present year The Port Authority disposed of \$12,000,000 Bridge bonds (Series C), bearing 4 per cent. interest, to obtain funds for the building of the Bayonne-Port Richmond Bridge, to a syndicate headed by the Guaranty Company of New York. There was spirited competition for the securities as was indicated by the following bids:—

Guaranty Company syndicate	99.777
National City Group	99.6419
Lehman Brothers syndicate	99.10
Dillon, Read and Co.	98.27

The highest bid represented a net interest cost to the Port Authority of 4.0109.

The bonds will fall due in increasing serial maturities from 1938 through 1953. They will be callable in whole or in part at 103, beginning January 3rd, 1938.

These bonds were put upon the market on January 9th, 1928, and immediately disposed of to the public at 101 per cent. of par. They represent an interest return to the investors of 3.82 per cent. to 3.93 per cent., depending upon maturity.

ACQUISITIONS OF REAL ESTATE.

In the acquisition of real property for large public works inflated prices are almost always encountered. The Port Authority, with this in mind, adopted the policy of having

careful appraisals made by competent persons in the several localities where real estate was to be acquired, of dealing directly with owners and of making purchase as early as feasible. In this way almost all of the real estate needed for the bridges has been secured at reasonable figures, the speculator has been forestalled and in only a few instances has the Port Authority been compelled to resort to the tedious and costly process of condemnation in the courts.

The first real estate which it was necessary to acquire was for the rights of way for the two Arthur Kill bridges. The Staten Island parcels were all obtained by private negotiation, and within the estimates, except that one plot at Howland Hook had to be condemned.

The unsatisfactory condition of one title at Perth Amboy, made necessary the condemnation of the property involved. Otherwise all the property needed at the Perth Amboy end of the Outerbridge Crossing was obtained through private negotiation and at figures within estimates and appraisals.

In Elizabeth all property required was obtained through negotiation. The costs were within the estimates and appraisals. Subsequently it was found necessary to acquire an additional area not contemplated in the original plan, the purchase of which is pending. Nevertheless the expenditures for real estate at this point promise to be within the estimates.

The purchases at Perth Amboy comprised 89 parcels involving 39 titles. Fifty-five parcels involving 20 titles made up the Elizabeth purchases. The purchases in Staten Island were mostly of acreage.

The acquirement of property for the Hudson River Bridge presented a more complicated problem as, on the Manhattan side, the land values were high and the improvements were extensive and costly.

However, by the close of 1927, 64 per cent. of the area needed had been acquired by negotiation, and negotiations were in progress for practically all of the additional property required. The purchase prices in the aggregate were below the estimates. Most of the property purchased was improved by apartment buildings, as is that still to be acquired.

The Port of New York Authority has continued the operation of these buildings. This operation has been advantageous because it has supplied information with respect to rental values and other particulars found to be helpful in negotiations with owners of property still to be acquired. Furthermore it has not caused any sudden disturbance to the large number of tenants in the buildings, who will, at their convenience, secure quarters elsewhere.

On the New Jersey side of the river at Fort Lee more than 70 per cent. of the property required was purchased during the year, comprising 48 parcels and involving 25 titles. Such of the improved properties as were not immediately needed for bridge purposes are being operated.

At the close of the year options had been obtained on approximately 125 parcels of property required for the Bayonne—Port Richmond Bridge. Because the plaza lay-out on the Port Richmond side had not yet been determined, greater progress was made on the Bayonne side, where agreements with owners have been reached on approximately 95 per cent. of property needed, exclusive of that occupied by industrial plants. The price agreed upon for this property is well within the appraised value. Title has already been taken to practically all of the property for which options were secured, the funds being obtained by the sale of notes aggregating \$1,000,000 in advance of the bond issue. On the Port Richmond side agreements had been reached with owners of approximately 75 per cent. of property required, exclusive of the plaza area.

The following illustrates the expenditures on account of real estate acquisitions for the four bridges:—

Elizabeth-Howland Hook Bridge	...	\$369,009.90
Outerbridge Crossing (Perth Amboy-Tottenville)	...	\$549,203.95
Hudson River Bridge	...	\$2,870,327.80
Bayonne-Port Richmond Bridge	...	\$878,654.60
Total	...	\$4,667,196.25

It has been the practice of the Port Authority in acquiring real estate to have all titles searched and insured.

Port of Grimsby.

TIDES AND FISHING.

The failure of two successive tides to produce sufficient water to enable the gates of the Grimsby Fish Docks to be opened on Friday, March 16th, and early morning, March 17th, thus seriously holding up the industry of the greatest fishing port of the world, raised at the time the question as to whether the tide was leaving Grimsby, and that in a few years to come Grimsby would no more function as an important fishing port.

In a chat with our Grimsby correspondent, Mr. G. L. Alward, an authority on tides in the Humber, did not concur in such a suggestion. He agreed, however, that this difficulty occasioned by tides would arise over and over again between moons. He instanced how, as far back as 1860, when steam was

unknown amongst fishing vessels, craft of this character with a draft of from 11 to 14 ft. used to ground in the Humber between the Burcom and the Grimsby piers. Since then, on numerous occasions there have been tides which failed to bring water sufficient to enable the dock gates to be opened to admit or let out vessels. In the past, however, there was this difference: that whenever a tide failed to produce the necessary bulk or height of water, the next tide more than compensated, inasmuch as it was more often than not an abnormal one. On the present occasion it stood out distinct from the others inasmuch as there were two such tides successively. Mr. Alward went on to say that to obviate this difficulty the Dock Company, the old Great Central Railway Co., constructed a new lockpit, but this did not solve the problem, which continued just the same. Later, when a second lockpit was contemplated, the Company was asked to make provision for a greater depth of water to meet the exigencies which would arise from time to time. However, the engineers of the Company declined to listen to the fishing trade. Thus, there would always be times when this annoying difficulty would crop up.

So far as the silting up of the Humber in certain parts is concerned, it has always been observed that, in times past, there must have been a silting up near to the Burcom previous to the Royal Dock (Commercial Dock) being built in 1854, as very old inhabitants of the port recall the days when the boys played cricket on the Burcom Sands.

A RETIREMENT.

During the past month Commander Hubert Basil Boothby, D.S.O., R.N.R., retired from the position of outdoor assistant to the Portmaster at Grimsby, a position he had held for seventeen years. At one time Commander Boothby was a captain in the Canadian Pacific Line, and previous to coming to Grimsby was the Fishery Officer for the North-East Coast, a district which stretched from Donna Nook to South Shields. Commander Boothby had a brilliant war service, and at the close of the war was in command of a big section of minesweepers at Peterhead. He also served in the Dover Patrol and commanded a section which took part in several important raids. He was the first merchant officer to gain the D.S.O. during the war. This distinction came after he had been twice blown up on the Scarborough Minefield. Commanded Boothby was also one of two brothers to receive a similar decoration during the war. On Monday, April 2nd, he was honoured by his former colleagues at a dinner held at the Oberon Hotel.

Port of Plymouth.

NEW DOCKS MANAGER.

Mr. Edgar C. Edwards, who is the new manager of the Great Western Railway Company's Docks at Plymouth, has had a lifetime's experience in dock work. Since his arrival at Plymouth from Penarth he has displayed the utmost interest in the duties of his new appointment and with the novel side of the work—the dealing with ocean mail and passenger traffic by means of tenders at all hours of the night—he is now thoroughly acquainted.

On the staff of the Great Western Railway at Plymouth Docks are two former captains of the Fishguard—Rosslare service. Captain Browning, the Dockmaster, lately succeeded Captain F. C. Rollin, who retired through ill-health; whilst Captain R. R. Mitchell, who lately came ashore, is Piermaster and Assistant Dockmaster.

DEATH OF COMMODORE.

A very old servant of the Great Western Railway Company's marine department has just passed away in the person of Captain Wm. Mulhall, who was the commodore of the Weymouth—Channel Islands service. His death occurred a month before he was due to retire on pension, but he had been ashore through sickness for some time before he passed away. Born in Plymouth sixty years ago, Captain Mulhall served his apprenticeship in sailing ships, and then joined the British India Company's service. Attracted later by the home trade, he took an appointment under the Great Western Railway Company's flag, and in due course commanded many of their steamers in peace and war.

FRENCH LINE CALLS.

The Compagnie Transatlantique, the French line, already are closely associated with the Port of Plymouth, as the "Ile de France," the "Paris" and the "France" regularly call at the western port, outward and homeward from New York. The West Indian steamers also avail themselves of the facilities at Plymouth on their way to and from Havre. The directors have decided that the "Cuba," "Lafayette" and "Espagne," now employed between Mexico, Cuba and Havre, shall call at Plymouth homeward bound. A monthly service is maintained, and under ordinary conditions the steamers will reach Plymouth on the 28th of each month, after calling at Portugal and Spanish ports, but the "Cuba" was to inaugurate the new service on April 20th.

Notes from the North.

ELECTRIC TRUCKS ON DOCK SERVICE.

Every dock and harbour authority is alive to the importance of providing facilities such as will enable ships to have a quick turn round, and thus brings us right away to the question of transport on the quays. It does not seem long ago, that even on the up-to-date dock system at Liverpool, practically the whole of the quayside transport was undertaken by hand-propelled trucks or bogeys, but since electricity has become available at nearly all the important docks, there has been provided a useful incentive for the employment of efficient and up-to-date cargo handling appliances. Electric trucking from the ship's side to the dock sheds where inward cargoes are stored pending removal to warehouses and consignees, is now increasing, and there have been observed such miscellaneous commodities as barrels of palm oil, giant logs of mahogany,



Rapid Transport on the Quays. Interesting Type of Electric Truck used at Gladstone Dock, Liverpool.

bagged produce, meat, bullion, and tobacco cleared by these handy little runabouts, whose power consumption works out at less than 2d. per working hour. On visiting Gladstone Dock a few days ago there was observed a useful application of the electric truck, manufactured by Messrs. Greenwood and Batley, of Leeds. This truck was working a cargo of rice. The bags were raised from the ship's hold in slings, in the conventional fashion. On being swung over-side, the slings, which held about one ton of cargo, were deposited on the super-structure or table carried on the platform of the truck which was immediately driven off to the shed where the super-structure was slid off the transport unit. The electric vehicle then took back to the ship's side, a lightened flat, which, at the point of loading, was exchanged for a loaded one. This procedure demonstrated how efficient has become the system for the rapid clearance of goods from the open quays. Handling operations were reduced to the minimum, as the truck all but loads and unloads itself. Working within a distance of 50 yards from the ship, it made a complete round journey in less than two minutes, and carried one ton per journey.

A PROFITABLE FERRY.

Wallasey Corporation Ferry undertaking is expected to show a net profit for the municipal year which ended 31st March, of approximately £26,000 compared with £10,000 during the previous year. The total receipts are estimated at £225,000 and the working expenditure at £149,000, leaving a gross balance of £76,000. Of this amount £50,000 is absorbed in the payment of loan charges and interest, the net balance thus being £26,000. The passenger service is producing a profit of £44,000 compared with £41,600 a year ago, while—and this is probably the most satisfactory result of the year's working—loss on the goods service in 1926-27 of £31,600 has been reduced to a loss of £18,000 only. The provision of the new floating roadway has, therefore, exceeded the most sanguine anticipations, and a still further decrease of the loss in running this public utility service is expected, as the new main roads from Wallasey through Leasowe and Moreton are constructed and the Seacombe goods service becomes more popular.

COSTLY RIVER IMPROVEMENT SCHEME.

Estimated to cost £126,000 a scheme is under the consideration of the Mersey Docks and Harbour Board to solve the problem of the dreaded Pluckingham Bank. The bank is a menace to shipping using the Brunswick Dock entrance, the main inlet to the south docks. The intention is to construct two great steel walls, or groynes, one on each side of the Brunswick Dock entrance, and reaching out a considerable distance into the river (the extent to be decided by experiment) so as to check the encroachment of accumulating sand upon the fairway. For this purpose the Board is to utilise the steel plates used in the construction of a dam at the Gladstone Dock,

thus cutting down the expense very greatly. The necessary equipment, including sheds and tracks for cranes has been recently assembled on both dock walls at the entrance so that the work might begin shortly. The operations will be in the nature of an experiment. While the groynes are being pushed out simultaneously, the behaviour of the sand will be watched, and, if the tests are satisfactory, permanent structures will be built. It is the hope of the Board that the difficulty will be overcome in this way, for a tremendous saving would thereby be effected. In 1925 a "dredging" war was declared on the perilous bank, and night attacks were delivered by the most powerful dredgers and sand pumps afloat. The Dock Board dredger Leviathan sucked up the unwanted sand through four huge pipes and moved off with 10,000 tons at a time. Giant bucket dredgers like the Walter Glynn and the Centaur also ate up the "enemy" at a great rate. But the cost in money was enormous and there was no end to the work. This dredging meant the expenditure of between £60,000 and £80,000 per annum during the past few years.

LANDING STAGE IMPROVEMENTS.

The Mersey Docks and Harbour Board has provided new waiting rooms on the Liverpool landing stage, as a means to abolishing the enormous queues that sometimes have to wait all night for the Isle of Man and North Wales Steamers. The rooms, which are situated at the north end of the stage, have been built at a cost of £28,894 and provide seats for 900 passengers and standing room for 5,000. The shipping companies will be charged 1d. per head for outgoing passengers and ½d. per head for incoming passengers for the use of the rooms. The rooms, built on the side of the former cattle staiths, contain booking offices and all conveniences. A covered way from Prince's Parade enables passengers to reach the boats dry shod in wet weather.

RIBBLE NAVIGATION DEFICIENCY.

It was reported to Preston Town Council that the estimated deficiency on the Ribble navigation accounts would be £30,000. Alderman Astley Bell told the Council that £32,000 would be raised from the rates in order to avoid large fluctuations in the rate call for this purpose. The total amount contributed out of the borough rate towards Ribble deficiencies up to the end of March was £1,481,240 approximately £1,500,000, not including the £32,000 to be raised during the current year. Against this annual "loss" of some £30,000 to £40,000, should there not be set the regular employment directly provided for some hundreds of men on the dock itself and for thousands indirectly in the many trades and industries served by the harbour and port, all of which, have enhanced the position and the aggregate wealth of the town? As a trading undertaking, the Ribble has earned a gross income averaging well over £200,000 for the past seven years, in spite of heavy handicaps, and although working expenses are still swollen by the need for a clearer channel to the sea, and although debt charges swallow up the revenue and rates as well, the actual revenue means a trade turnover that cannot be despised or discounted. A good case could be made out for a bolder policy in securing a permanent deep channel.

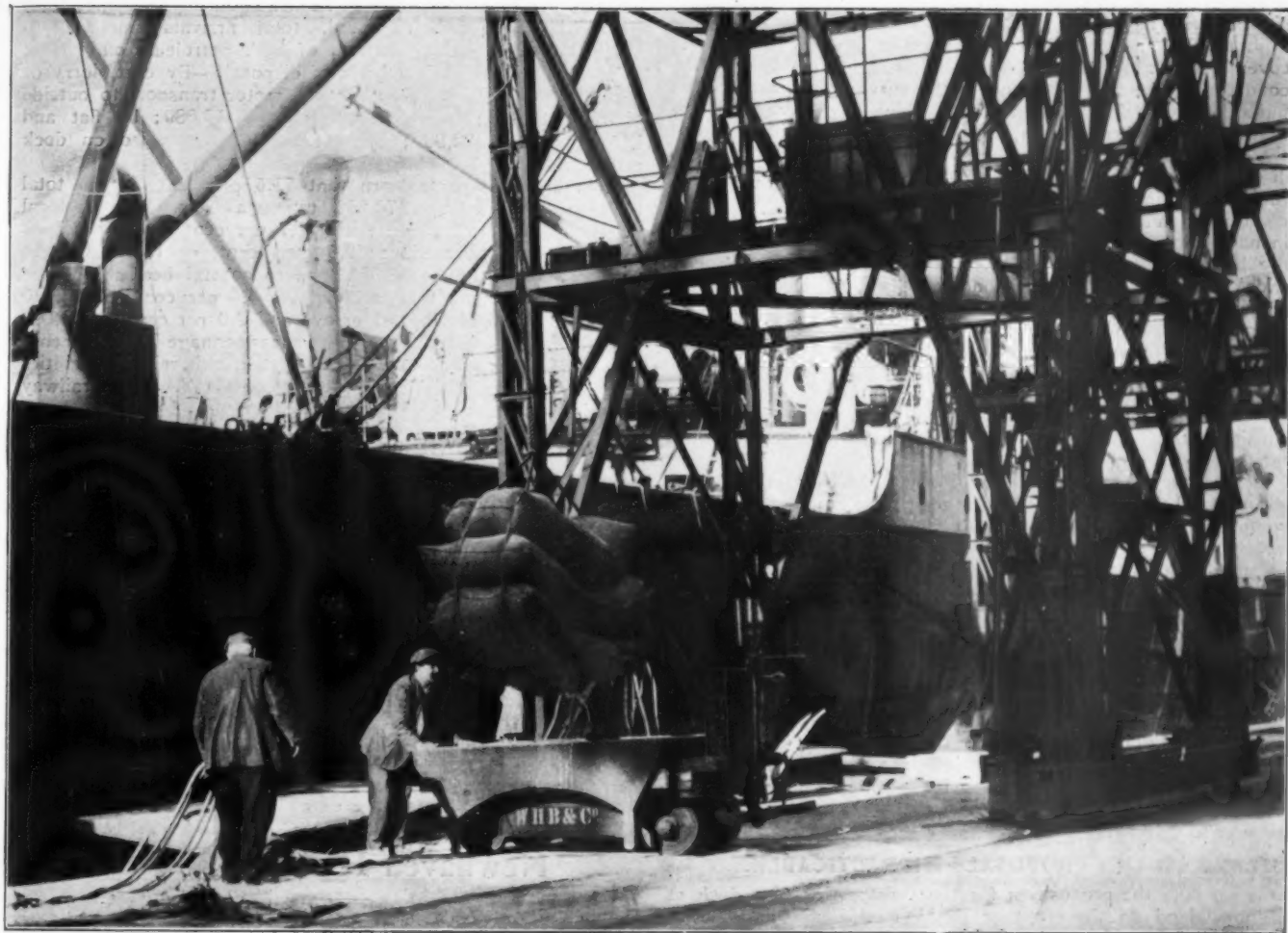
ROYAL VISITORS TO GLADSTONE DOCK.

When the King and Queen of Afghanistan visited Liverpool they took the opportunity of inspecting the famous Gladstone Dock system. Driving directly from the Cotton Exchange to the Gladstone Dock, their Majesties entered the dock estate by the Strand Road gate and reached the east end of the shed at the south side of the Gladstone Branch Dock No. 1, occupied by the Blue Funnel Line. Alighting at the door of the shed, they were received by Mr. Richard D. Holt, chairman of the Dock Board, who presented the following members of the Dock Board:—Messrs. H. Sutton Timmins, Chas. Livingston, H. F. Fernie, W. Smellie and Colonel J. G. B. Beazley, with Mr. T. M. Newel (Engineer-in-Chief), and Mr. L. A. P. Warner (General Manager). The unpropitious state of the weather led to the curtailment of the programme at the dock. Re-entering their cars the King and Queen were slowly conducted through the shed, and had the opportunity of watching, en route, the operations of loading and unloading some of the liners berthed alongside the quays. It was a very restricted view they were able to obtain through the windows of their car, but the heavy rain prevented them making the journey on foot. Continuing their inspection, their Majesties viewed the great lock, 130 ft. wide and 1,050 ft. long, through which the huge liners gain access to the Gladstone series of docks. It was, however, all very hurried, the weather preventing their Majesties from making anything akin to a close inspection of the unique facilities of the Gladstone Dock system.

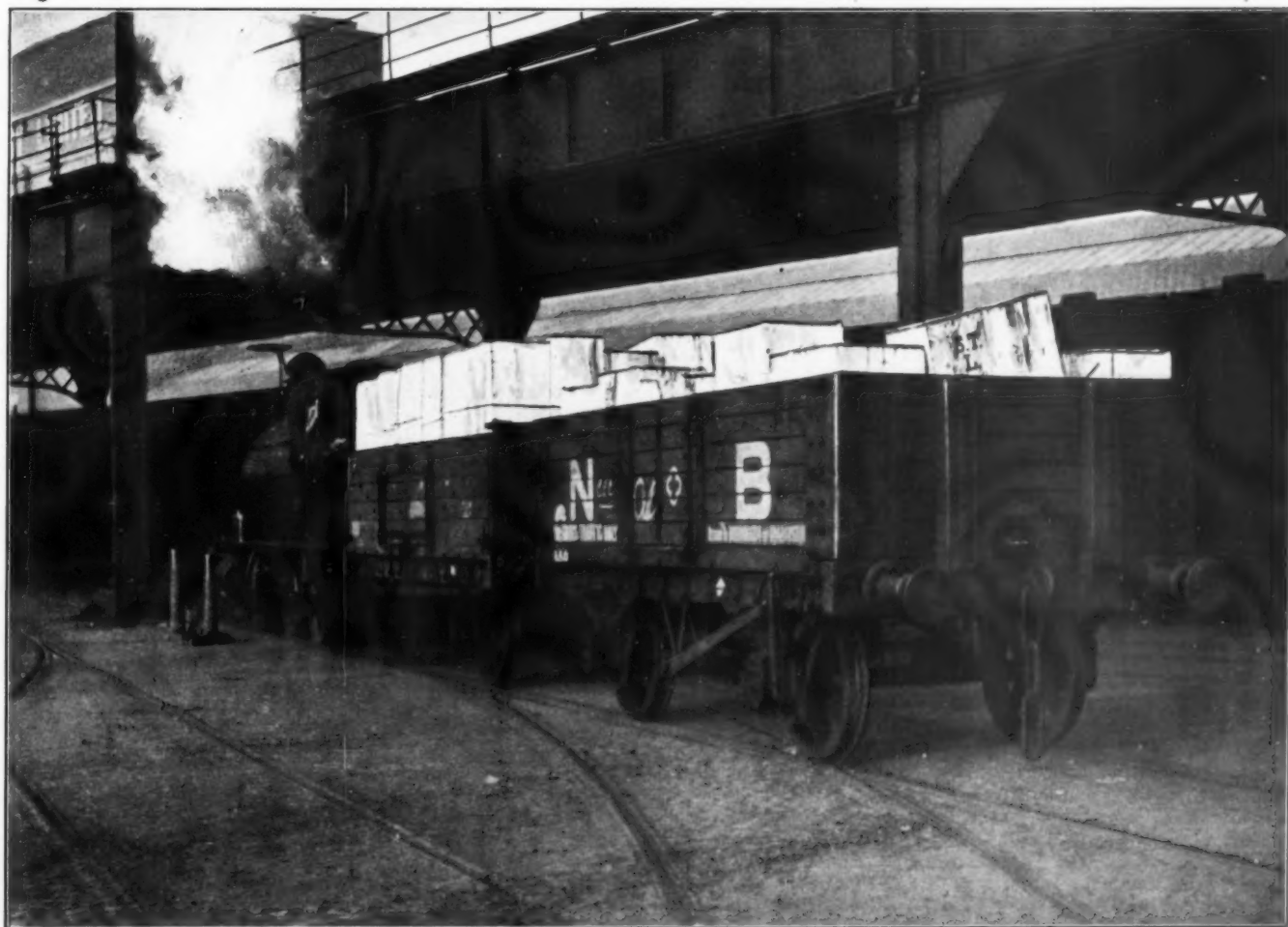
THE MERSEY IN MINIATURE.

To study the effects of the tides and currents upon the bed of the River Mersey and the channels, the engineering department of the Mersey Docks and Harbour Board has a wonderful working model of Liverpool Bay and the River Mersey. This model which is 60 ft. long by 30 ft. wide, and is housed at Albert Dock, reproduces exactly, to scale, not only the under-water geography of the bay and river from well beyond the bar lightship to Warrington (over 30 miles), but

The Docks of Liverpool.



Electric Trucks at Gladstone Dock, Liverpool, receiving Slings of Cargo at the Ship's Side. Hand-propelled Bogeys, though still popular, must eventually give way to this method of transport on the Quays.



Liverpool Dock Estate. Loaded Trucks being removed from the Quayside. The Superstructure is the Liverpool Overhead Railway, which runs the length of the Liverpool Dock

also all the tides and complicated currents actually prevailing. A huge tank has been constructed, with its sides conforming to the configuration of the coasts and river banks and at the seaward end of this, four great plungers or "displacers" sink and rise at regular intervals and so cause the water in the tank to ebb and flow in response. The bed of the tank is covered with sand, which was at first roughly moulded to the condition of the bay according to the survey of 20 years ago; but tides, equal in number to those which have occurred since that date, have been run in, and have reproduced in the model the conditions now obtaining. The purpose of the model is to discover the effect of tides and currents on the river itself and the manner in which the West Crosby and Taylor's Bank revetments influence these in the scouring of the channel used in navigation. At flood tide 300,000,000 cubic yards of water are brought into the river through the bottle-neck (5,500 ft. wide) between New Brighton and the Gladstone Dock, and the aim of the Dock Board is to conserve the tremendous scouring action of this, by counteracting the natural tendency of the tides and currents to bank up sand and shift the curve of the channel used by navigation. This model shows the effect of various experiments with the position, length, and height of the revetments, and the results obtained are now under consideration. By means of cork discs the complicated movements of the surface water at rising or falling tide may be closely observed, and various stains introduced to the bed of the channel, give accurate and valuable information as to the complex movements below. The model depends upon the action of the mechanism, which is electrical, and so finely balanced that with a finger and thumb one may turn a knob which lifts the two-and-a-half tons of water into the tank, to produce the flowing tide. When the model is working, high and low water occur every 126 seconds.

JETTY IMPROVEMENTS AT DINGLE.

The Mersey Docks and Harbour Board is making preliminary arrangements for carrying out plans passed some time ago for the extension of the South Dingle oil jetty to meet the growing needs of the oil importers. The jetty is to be extended 198 ft. to the southward, thus increasing its total length to 700 ft. It has been estimated that the cost of the necessary dredging will amount to £13,291.

HILBRE ISLAND PROPOSALS IMPRACTICABLE.

What puts the proposition for the construction of a dock at Hilbre Island on the coast of the Wirral Peninsula, outside the range of serious discussion, is the question of cost. Dredging is the only method by which what remains of Hilbre's natural harbour could be restored to anything approaching its one time usefulness. Unless a training wall or revetment were erected in the hope of preventing the sand from returning almost as quickly as it was removed, a dredger would have to be kept constantly at work. There would be little chance at Hilbre of reaping the smallest harvest in the way of harbour charges.

In few harbours do fishing boats or yachts pay dues, and certainly not in harbours that dry out. One of the first essentials for a yachting centre of any importance is good anchorage at all states of the tide. No one who has experience of living in a yacht feels any attraction for a harbour which involves the acute discomfort of grounding at low water.

I.O.M. HARBOUR WORKS.

The Isle of Man Tynwald Court has decided to allocate £3,500 to enable the Isle of Man Harbour Commissioners to further improve the berthage of the Alfred Pier, Port St. Mary, by the excavation and removal of rock over an area of 64 ft. by 100 ft. landward of the wall remaining after the experimental dredging operations in 1927, so as to give a depth of 4 ft. at l.w.o.s.t. The sum voted is in addition to the sum of £2,000 voted by the Court on the 29th April, 1927. Recent work was stopped at a place where the pier is most used and forms what is called a bar between the low and high ground. It is intended to extend the pier further landward to a position on the slipway, where the pier is not much used.

WALLASEY DECIDES ON PIER IMPROVEMENTS.

Wallasey Corporation Works Committee has resolved that of the ten tenders received for the supply and erection of about fifty tons of mild steel undertracing for the New Brighton Pier, that of William Cubbin Ltd., Birkenhead, for the sum of £1,758, be accepted. The Borough Engineer has been instructed to dismantle the existing structures on the Pier. The Committee has decided to recommend the Council to make application to the Ministry for sanction to borrow a sum of £29,500 for the extension of the sea defence works for a distance of 800 yards westwards from the present termination, and that application be made to the Unemployment Grants Committee for a grant towards the cost.

The corroded steel girders beneath the deck of the promenade pier at New Brighton, are being replaced, and the refreshment rooms are to be pulled down and reconstructed. The expenditure on this work is estimated at £15,000. The amount paid by the Wallasey Corporation for the structure as it stood was £18,000 and the original cost sixty years ago, was £38,000.

M.D.H.B. RETURNS.

We are indebted to the Mersey Docks and Harbour Board for the statistical summary, showing the disposal of foreign cargoes at Liverpool and Birkenhead during the month of February, during which period, total arrivals amounted to 551,240 tons excluding imports of bulk petroleum oil. Here is an analysis of the methods of disposal:—By cart, lorry or motor lorry, 320,297 tons; by road motor transport to outside districts, 31,724; by overside delivery, 152,089; by flat and barge ex quay, 22,885; by railway wagons loaded on dock estate 24,245.

It is illuminating to learn that 71.5 per cent. of the total tonnage representing 272,252 tons was consigned to local warehouses, factories and mills; 8.7 per cent. or 47,836 tons to local railway stations; 2.5 per cent. or 13,488 tons to foreign berths; 2.8 or 15,639 tons to coastal berths; 1.1 per cent. or 6,188 tons to canal depots; 4.5 per cent. or 24,740 tons to canals and Upper Mersey; and 8.9 per cent. or 49,063 tons to other destination. Of the gross tonnage 79.6 per cent. or 438,847 tons was cleared from berths with railway facilities and 20.4 per cent. or 112,393 tons from berths without railway facilities.

Mr. WARNER TO DECLARE ON "DOCKS."

Mr. L. A. P. Warner, general manager of the Mersey Docks and Harbour Board will be one of the speakers at the Congress of the Institute of Transport, to be held at Liverpool on May 17th, 18th and 19th. He will speak on the subject of "Docks." This Congress should be one of outstanding interest, for the subject of transport is very closely bound up with the progress and prosperity of every dock and harbour undertaking. Two of the greatest experts in the country on their own subjects, Sir Josiah Stamp on railways, and Sir Norman Hill on shipping, will also address the Congress. Sir Josiah will read a paper on "Railways," and Sir Norman, who formerly practiced the law in Liverpool, will contribute a treatise on "Shipping." At the same conference another recognised expert, Mr. John A. Brodie, the late city engineer of Liverpool, will speak on "Roads."

Newhaven Harbour Works.

Reconstruction of East Pier.

The existing East Pier was constructed under the auspices of the Newhaven Harbour Company nearly 50 years ago, and is a timber structure with its lower portion sheeted up to 5 ft., above low water level on the fairway side the top portion being open to the sea. The lower or sheeted portion of the pier acts as a groyne and prevents the sand and shingle from passing through and silting up the harbour mouth.

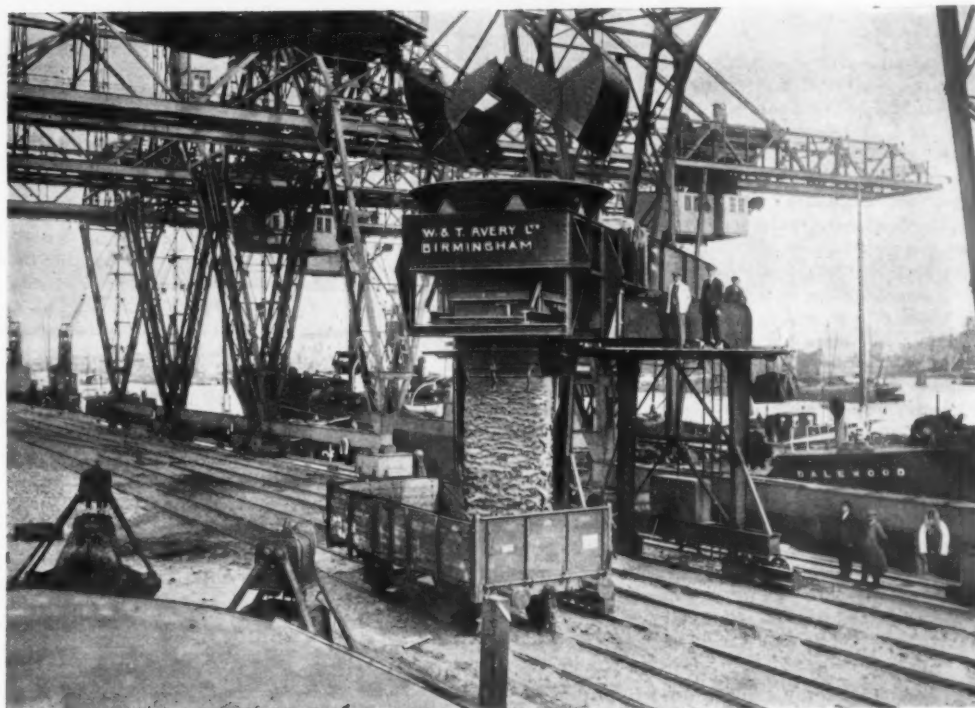
The pier, which has been extended since it was originally constructed, is just over 500 yds. long with a lighthouse at the sea end, and, owing to the wastage of the timbering through exposure to the elements, it has been decided to reconstruct it entirely of reinforced concrete at a cost of nearly £100,000. The reconstruction will, it is anticipated, be completed in about two years' time and the contract for the work has been let to Messrs. A. Jackaman & Son, Ltd., of Slough.

The new pier will, as regards type of structure, follow generally the same lines as the existing one, but owing to the trestles of the new pier having to be made with the existing ones in place, it will be necessary to employ specially designed apparatus for the driving of the piles and pile sheeting, while special travelling gantries will be erected for handling the materials required for the reconstruction work.

The main trestles are placed at 7 ft. 6 in. centres and consist mainly of three piles. The outer piles are driven at a batter of 1-in-5 at the sides of the pier, and the third (middle) pile, which acts as a raker to resist lateral movement of the pier, is driven at 1-in-3. The piles are braced with diagonal and horizontal bracings 15 in. by 15 in. reinforced with four 1 in. diameter rods. The front piles to which the sheet piling is connected by a head beam are 18 in. by 15 in. reinforced with six 1½ in. diameter rods with 3/16 in. diameter links, the back piles 15 in. by 15 in. with four 1½ in. diameter rods with 3/16 in. diameter links. They vary in length from 45 ft. to 60 ft. and are to be pre-cast.

It is proposed to complete the work in two stages, commencing the first from about the middle of the pier and working shorewards, and the second stage from the pier head. The width of the pier from this point to the shore is 26 ft. 1 in. with a deck of 7 in. slabs reinforced with ½ in. diameter rods spaced at 8 in. centres. The cross beams carrying the deck are supported on trestles suitably braced 7 ft. 6 in. apart. They are 23 in. deep and 15 in. wide and are doubly reinforced with four 1½ in. diameter bottom rods with ¾ in. diameter stirrups and four 1½ in. diameter top rods.

To allow for expansion joints in the pier, two trestles with an intervening space of 2 in. will be placed at intervals of 20 bays, i.e., 150 ft. centres.



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Book Reviews.

"The Directory of Contractors and Public Works Annual, 1928." Edited by C. W. Bigger. Wightman and Co., Ltd., London; 17s. 6d.

This is the 39th annual volume of the Directory of Contractors, and its features continue to increase both in number and value. The scope of the volume is very extensive, and comprises the names and addresses in Britain of contractors undertaking all kinds of work in connection with railways, docks, harbours, rivers, bridges, waterworks, gasworks, tramways, reinforced concrete, drainage, building, steel houses, cartage, haulage, lighterage and greyhound race tracks.

Similar particulars are given in respect of architects, professional and public engineers associated with national and local authorities, railways, waterworks, sanitation, gasworks, tramways and works of similar character. The principal members are given of such bodies as the Port of London Authority, Thames Conservancy, Metropolitan Water Board, the City Corporation, the London County Council, the Ministry of Transport, the Office of Works and other Government Departments, town clerks, surveyors, engineers all over Britain, railway engineers, dock and harbour engineers, tramway managers, shipbuilders, merchants and exporters of contractors and engineering materials, commercial and industrial engineers. There is also a list of important public works under construction and a valuable contractors plant and material buyers guide.

The volume, although comprehensive, is most compact, and the letterpress is clear and easy to refer to. The Directory of Contractors is of constant service in the library of the engineer and public authority.

"Dues and Port Charges on Shipping throughout the World." Edited by Robert Ritherdon. George Philip and Son, Ltd., London. £4 4s. 0d.

The present issue of this monumental work of reference constitutes the eighteenth edition and comprises four volumes arranged geographically:—I. Europe and Africa; II. America, Asia and Australia; III. British Isles; and IV. a Compendium of World Commerce.

The first three volumes in the set dealing with harbours, their dues and charges, have been edited by Mr. Robert Ritherdon, late editor of "Lloyd's Weekly Shipping Index," and for nearly half a century associated with the Committee of Lloyd's. No better tribute can be paid to the quality and utility of this trilogy of shipping manuals than to state that the broad sweep of their plan encompasses the ports of the Globe, both large and small, with detailed care.

The volumes under consideration run to an average length of 900 pages; the type is clear, and each book conveniently portable. They are, however, essentially works for the office desk and cabin, where appreciation must grow day by day by the scope of the data and their response to reference.

The contents may be gathered from the fact that information concerning harbours of importance includes: accommodation, actual disbursements, agency fees, anchorage dues, ballast, bills of health, boat hire, brokerage, canal systems and up-river ports, coaling facilities, commerce, Consular fees, cranage, currencies, Custom House rules, Customs dues, depths, docks, dry docks, emigration, entrance and clearance fees, exports, floating docks, foreign weights and measures, gratuities, graving docks, immigration, imports, internal communications, labour, lastages, light dues, lighterage, manifests, mooring fees, oil-fuelling facilities, patent slips, pilotage, population, port charges, pro-forma charges, provisions, quarantine, sanitary fees, stevedoring rates, tonnage dues, towage, water, wharfage dues and wharves.

Alterations in depths of water and general facilities have been duly included in the new edition. At the same time, it is noted that expenses at foreign ports have become simplified by the increased stability of foreign currencies. Several hundred additional ports find a place in the volumes, while the canals and waterways between the Danube, Elbe and Oder are scheduled. Data given includes oil fuelling, facilities and recently installed fuel-oil stations.

Volume IV., edited by E. G. R. Taylor, B.Sc., F.R.G.S., is a Compendium of World Commerce. This is an entirely new encyclopaedia which surveys the countries of the world geographically and commercially, together with details of post-war trade conditions and markets. Thirty-two coloured maps are also incorporated. A typical description includes area and population of country, chief towns, geographical position, climate, physical characteristics, trade and economic conditions, raw materials, articles of commerce (inward and outward), trade relations, with general information on currency, religion and similar matters. This volume may be purchased separately at 25s.

It is a book intended essentially as a corollary to the three volumes on port dues, and should be appreciated alike by those engaged in active trade relations with various parts of the world and those whose professional duties direct their attention abroad. It need hardly be added that the British

Isles finds a place in the pages of this useful book. The Port Authority might well have a copy in each department concerned with the movement of goods. Certainly no importer or exporter dealing in any considerable variety of materials should be without it.

Facilities at the South Wales Ports.

New 125-ton Floating Crane.

Since the amalgamation, the Great Western Railway Company, with the object of raising the docks to a high state of efficiency, have considerably improved the facilities, and have provided a large number of additional works and appliances. This is further instanced by the purchase of a 125-ton floating crane, which will be available for use at any of the South Wales ports.

The crane has a lifting capacity of 125 tons, with two tackles on a distance of 25 to 30 ft. from the fore side of the pontoon, and a third tackle of 10 tons at a distance of about 10 ft. from the centre of the main lift.



The New 125-ton Floating Crane.

The height of the main lift blocks is located about 80 ft. above the deck of the pontoon.

The dimensions of the pontoon are as follows:—Length, about 83 ft.; breadth, about 47 ft.; depth, about 9 ft.

A photograph of the crane is reproduced herewith.

There is no doubt that the provision of this further facility will prove of great benefit to shipowners, merchants, manufacturers, etc., and the Company hope that advantage will be taken of this new appliance.

Prior to the purchase of this floating crane, lifts were restricted at the South Wales ports to 70 tons, but the Company have been for some time aware of the demands for a more powerful crane, and to meet such demands, the Company have purchased this crane.

The Great Western Railway Company are doing everything in their power to develop the trade of South Wales, as is evidenced by the recent reductions in dock dues and charges, and again by the purchase of additional appliances capable of dealing with all classes of traffic passing through the Company's docks, and it is hoped that full advantage will be taken by shipowners and traders of this new facility.

PERSONAL.

Mr. William Davies, for the past twenty-five years superintendent of graving docks with the Mersey Docks and Harbour Board, has passed away. Mr. Davies was formerly a docks superintendent at Cardiff. He came to Liverpool in 1903 and was prominently connected with reconstruction work on the Gladstone Graving Dock.